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MOGOLLON
CULTURAL CONTINUITY AND CHANGE

The Stratigraphic Analysis of Tularosa and Cordova Caves

PAUL S. MARTIN

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ROGER GRANGE, JR.

FIELDIANA: ANTHROPOLOGY
VOLUME 40
Published by
CHICAGO NATURAL HISTORY MUSEUM
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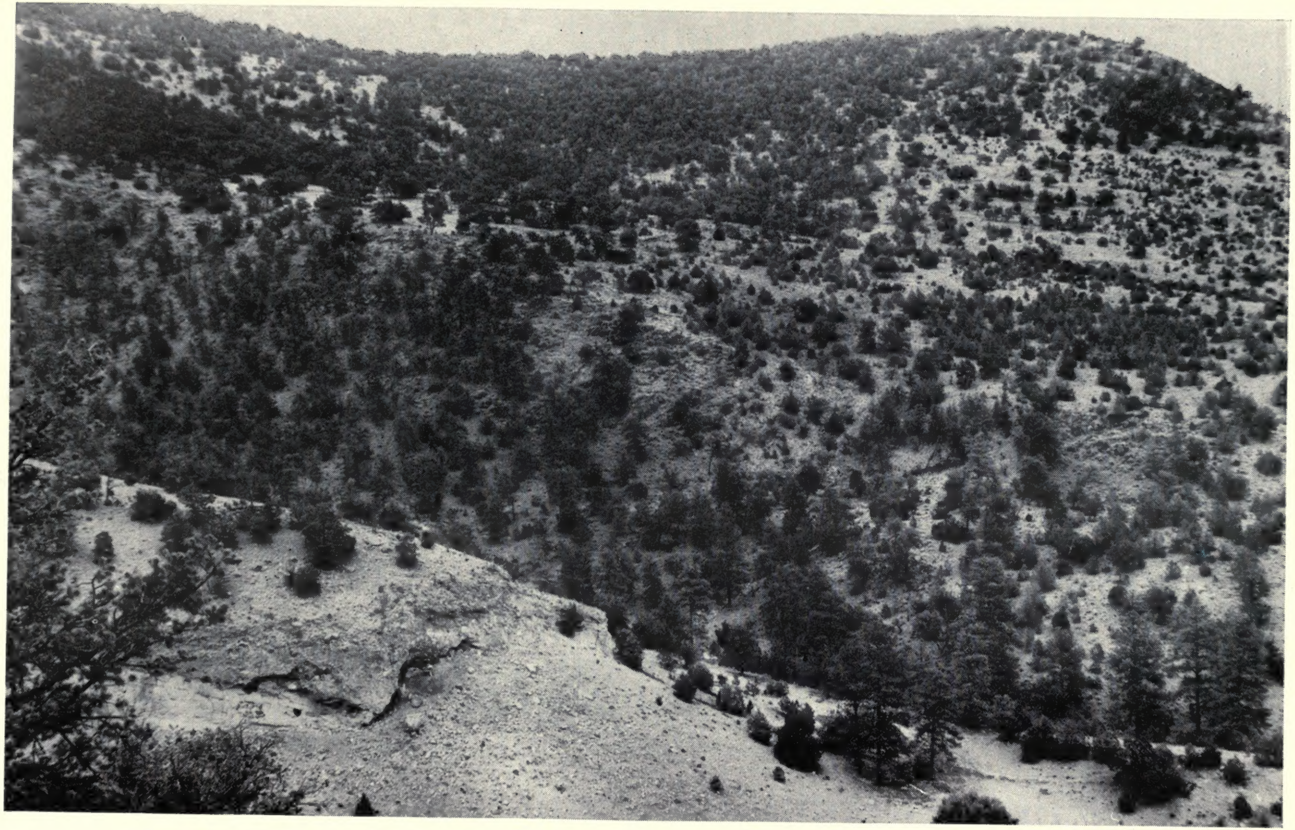

FIG. 1. Panoramic view of Tularosa Cave, looking east.

MOGOLLON
CULTURAL CONTINUITY AND CHANGE

THE STRATIGRAPHIC ANALYSIS OF TULAROSA AND CORDOVA CAVES

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Preface

When we started our long-term archaeological investigations in west central New Mexico in 1939 we hoped to divide our digging time about equally between open and cave sites.

For several reasons, however, all of our excavations, up to the season of 1950, had been restricted to open sites. By this time, we had accumulated a useful body of data that cast some light on the Mogollon culture, but their usefulness was limited by lack of two requisites: (1) A testing, by stratigraphic sequences, of the typological sequences we had developed for scattered, open sites; and (2) a representative collection of perishable Mogollon materials.

Up to this time only two large collections of perishable items from caves in the Mogollon area had been reported: one by Hough (1914) and one by Cosgrove (1947).

The materials collected by Hough, some of which came from Tularosa Cave, were neither well documented nor placed chronologically. Those reported on by Mrs. Cosgrove were exceedingly well described and illustrated but they lacked stratigraphic placement and further suffered from the fact that the author had attempted to fit them into the Anasazi sequence. This last remark is not a criticism, because the Mogollon concept had not been developed when Mrs. Cosgrove wrote her report. It is the kind of defect from which any report may suffer because new investigations often modify or supplant that which has gone before. Certainly, some time in the future, students will criticize our own study and will feel frustrated because we did not obtain the proper information.

All this is by way of saying that we were eager to obtain dry materials to which relative or absolute dates could be assigned. If this goal could be attained, then a comparative study of the perishable materials from the Mogollon, Anasazi, and Hohokam cultures would be meaningful. Perhaps such a study would test the validity of the hypothesis that the Mogollon is a taxonomic entity and should be considered on an equal basis with the other sub-cultures of the Southwest—the Anasazi and the Hohokam. However, this kind of study was impossible with the published data at our disposal.

Caves are scarce in and near Pine Lawn Valley, partly because of the rock mantle, which was volcanic in origin; but a few caves were located and two were excavated, one in 1950 and another in 1951.

The results of the work (1950) in Tularosa Cave (Fig. 1) were unexpectedly remarkable, for the site yielded a rich harvest of well-preserved specimens. In a few squares, we excavated fourteen levels of 20 cm. each, making a depth of almost 3 meters, and recovered 2,130 specimens, exclusive of the bushels of plant remains.

The earliest Carbon 14 dates on the corn recovered from the lowest levels were 2,300 years ago ±200 and 2,223 years ago ±200. We estimate that the cave was abandoned somewhere between A.D. 1000 and 1200. If these dates are reasonably accurate, we may say, then, that Tularosa Cave was occupied more or less continuously for about 1,500 years ±500.

Cordova Cave (1951) yielded less spectacular results, fewer specimens (1,200) and fewer plant remains. The total depth of débris was about 2 meters. A conflagration that had occurred in the cave during the Pine Lawn Phase had destroyed most of the perishables, and after that the cave had been occupied infrequently and for short periods. On the other hand, the excavations in Cordova Cave corroborated the stratigraphic sequence of Tularosa Cave and provided us with additional specimens of dry materials as well as additional variations of type established for the materials from Tularosa Cave. These variations are tablitas, tools of stone, and sandals. We have no dates for Cordova Cave but we guess that it was occupied more or less continuously from about 300 B.C. to A.D. 1 and intermittently from A.D. 1 to about A.D. 900.

The excavations in these caves provided us with a goodly quantity of perishable materials from many categories, all of which were securely anchored in time and space by the stratigraphic association with considerable quantities of stone specimens and pottery. After our specimens had been studied, we were able to enlarge for comparative purposes the total numbers of objects and categories by using those undocumented or undated materials that Hough and Cosgrove had described and illustrated in their publications. (I only hope that our illustrations and descriptions may be as good as those in Mrs. Cosgrove's report. We have tried to model our work on hers.) For example, we found only two portions of true hunting bows; Mrs. Cosgrove found four complete ones. We can demonstrate that the atlatl was declining in favor during the San Francisco Phase and that the bow was supplanting it. Our evidence plus the Cosgrove specimens enlarges our knowledge of the bow situation. We found only a few arrows; Mrs. Cosgrove found many. Conversely, we found many juniper-berry skewers or sticks; Mrs. Cosgrove, a few. Thus our totals have been enlarged by the Cosgrove materials, and those materials have been assigned chronological and cultural positions by our work.

The caves excavated in 1950 (Tularosa) and in 1951 (Cordova) are both located in the Apache National Forest, Catron County, New Mexico. Tularosa Cave is a mile or so east of Aragon, New Mexico, on the state highway from Reserve to Datil (Number 12). Cordova Cave is about six miles south of Reserve, New Mexico.

Our archaeological investigations were conducted under a permit issued to Chicago Natural History Museum by the Forest Service, United States Department of Agriculture. Mr. R. B. Ewing, Forest Supervisor of the Apache National Forest, Springerville, Arizona, has been of the greatest assistance to us in all ways.

Our concentration of eight years' work in Pine Lawn Valley constitutes one of the longer investigations in a limited area in the Southwest. Reports on all of this field work have been published. This record would not have been possible had it not been for the continuing and deep interest of Mr. Stanley Field and Colonel Clifford C. Gregg, respectively President and Director of Chicago Natural History Museum, and our Board of Trustees. We are happy to have the opportunity to express our thanks in this manner.

No field work is possible without a loyal and able staff of assistants, each of whom has some special ability that is necessary to carry on our intensive investigations. We are grateful to these assistants.

In the season of 1950 we were aided by the following: Mr. James Barter, in charge of cataloguing (later in the season, he was assisted by Miss Elaine Bluhm); Mr. W. T. Egan, photographer and surveyor; Mrs. Martha Perry, cook; and Mr. Donald Thompson, assistant to Dr. Rinaldo.

In 1951 our assistants were Mr. Thomas P. Alder, photographer; Mr. Arnold Besser and Miss Marjorie Kelly, assistants to Dr. Rinaldo; Miss Elaine Bluhm, in charge of surveying and cataloguing and of excavating Fox Farm site (to be reported on in 1952); Miss Elizabeth Morris, assistant to Miss Bluhm; and Mrs. Martha Perry, cook.

Our corps of diggers, who deserve praise for their careful work and cheerful mien in spite of respirators, goggles and much dust were Juan Armijo, Clyde and Stanley Jones, E. P. Martinez, Pablo Serna, Willy Serna, Mitchell F. Smith, Jake Snyder, and Stephen D. Towle.

Mrs. Mary Crackel, proprietress of the Pine Lawn Tourist Camp, looked after our camp property during the winters and was truly a good neighbor in innumerable ways. No favor was too much trouble for her to grant and her hospitality to our guests is widely known.

Great assistance has been freely and enthusiastically given by many experts in various departments of the Museum. Without this generous and interested aid our report would lack details, authority, and other essential contributions. We gratefully acknowledge assistance from the following members of the Museum staff:

Dr. Ernst Antevs, Research Associate, Glacial Geology; Mr. Emmet R. Blake, Associate Curator, Birds; Mr. D. Dwight Davis, Curator, Vertebrate Anatomy; Dr. Hugh C. Cutler, Curator, Economic Botany, whose chapter on plant remains is contained in this monograph; Mrs. Dorothy B. Foss, Osteologist; Dr. Fritz Haas, Curator, Lower Vertebrates; Miss Agnes McNary, Secretary, Department of Anthropology; Miss Lillian A. Ross, Associate Editor, Scientific Publications; Dr. Sharat K. Roy, Chief Curator, Department of Geology; Mr. Colin Campbell Sanborn, Curator, Mammals; Mr. Melvin A. Traylor, Jr., Research Associate, Birds; Mr. Rupert L. Wenzel, Curator, Insects; and Dr. Robert K. Wyant, Curator, Economic Geology.

Messrs. Angelo Anastasio, John Buettner-Janusch, George Talbot and Howard Winter, graduate students in Anthropology at the University of Chicago, helped sort materials after they arrived at the Museum.

Mr. Clair E. Gurley, President of the Central Motor Company, Gallup, New Mexico, who has been our friend for years, has furnished us transportation at cost and has aided us in many other ways. We are deeply grateful to him.

Dr. Charles W. Keney, physician and surgeon at Gallup, New Mexico, has acted as consulting physician to members of the Expedition. We are indebted to him for advising us by long-distance telephone and for personal consultations.

At the end of the work in 1950, we proceeded to analyze our materials and to write our reports. In the spring of 1951, at which time we knew we were about to dig another cave, we decided to withhold the monograph on Tularosa Cave and combine it with the data and analyses of the season of 1951. This was done to save time, duplication of descriptions, and publishing costs. Thus, two reports are combined in this volume.

The present monograph is the work of many contributors. The authors of the various chapters are noted at the commencement of each chapter. The section on "Wooden Artifacts," by Roger Grange, Jr., Assistant in the Department of Anthropology at the Museum, has been presented as his dissertation in partial fulfillment for the degree of Master of Arts, Department of Anthropology, the University of Chicago.

Mr. Phillip Lewis, University of Chicago Fellow to the Museum, traced the map and seriation charts.

Mr. Gustaf Dalstrom, staff artist in the Department of Anthropology, is responsible for the line drawings of sandals.

PAUL S. MARTIN

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I. Organization of Report

By PAUL S. MARTIN

The organization of a report, we think, is almost as important as the content.

With this thought in mind, we have tried to put this one together in such a way as to make it easily usable, by specialists, students, and general readers, and to make it readable. To achieve this, we have included illustrations, drawings, charts, a map, and an index and have placed these in their logical settings. We have brought together the descriptions of each type of artifact from both caves and the tally for each type; we have stated in either the text or the legends for the illustrations the provenience of each specimen (by site) and have integrated specimen, provenience, and illustration. We have assigned chronological positions to all materials and have made a synopsis of significant categories under such subject headings as "Clothing," "Household Equipment," and the like; these subjects have also been grouped by phase and by site. Finally, we have added interpretations, comparisons, a summary, and conclusions.

In the past decade, several excellent discussions concerning taxonomy have been published. The latest one (Phillips, Ford, and Griffin, 1951, pp. 61–68) deals principally with pottery types and is an excellent statement of the problems involved. In this report taxonomic problems *per se* will not be ventilated at length. A few of our assumptions and terms will be explained.

As Rinaldo sets forth in Chapter II, the caves were dug by squares and levels. The assignment of chronological positions or of phases to each level was done entirely on the basis of the proportions of types of pottery present in the levels. This is admittedly arbitrary, but appears to be sound practice. The levels that contained no pottery (plus those that held very few chance sherds) were classified as "Pre-Pottery." A level containing plain and textured wares plus late painted types such as Reserve Black-on-White was assigned to the Reserve Phase. For an actual example of how this was done, see Rinaldo's description of pottery of Tularosa Cave, Chapter III.

The assignment of particular levels to a given phase was tested by Rinaldo by using the standard formula (Chapter III, p. 53) in any test of association. Thus, if he was in doubt as to whether a particular level should be classified as of the Georgetown Phase or the San Francisco Phase, the above test was used. The assignment of phases or chronology to any one level may be in error but the chances are that 95 per cent or more of our determinations are correct. At any rate, that is the way we worked. Therefore, any articles found in a given level to which was assigned a phase (or date, and I use the terms interchangeably) were automatically of the same phase; for example, a sandal found in an undisturbed level yielding only plain wares was called a sandal of the Pine Lawn Phase.

We are well aware of the dangers of the phase or any other taxonomic system; but we use the Gladwin phase-system because it is simple and because it seems to fit our particular needs and problems. Thus, we are trying to speak the same language that most other Southwestern archaeologists use so that we can all meet on common ground.

We realize that a phase is an artificial and chronological system superposed on man-made materials and no matter how one thinks of a phase there are pitfalls to be avoided; but to bring order out of chaos, to arrange a mass of data so that they can be scrutinized, we have one purpose in mind, namely, to make generalizations concerning man's behavior in the past. Perhaps some day, useful conclusions can be drawn from these generalizations on patterns of behavior and on the laws of culture processes and change.

Actually, we know that there is no break between phases and that phases are merely arbitrary culture groupings set off in arbitrary units of time. A culture is a continuum broken only by our arbitrary divisions or phases. We can and have demonstrated by our seriation charts (of pottery, houses, tool types) that the data that we have unearthed and pieced together form a cultural continuum in which man's development (culture) is slow, steady, and progressive. Man was and still is trying to progress, to attain power, by controlling the natural forces about him (Becker, 1949). The Indians controlled their environment to a limited extent by domesticating corn, beans, and squash, and thus assuring themselves of a more stable food supply.

But further, the term "phase" is thought of in different ways by us: (1) If we think of a sandal as being "San Francisco" we mean that it was probably made some time between A.D. 700 and A.D. 900. (2) If we are thinking of phases as such, we have difficulty because we do not think in chunks of history; we conceive of a phase merely as part of a culture continuum just as the passing countryside and towns are part of a rail journey. (3) We may also think of a phase as a particular moment in history in which an innovation took place. Let us take the introduction of pottery, for example. We are fairly certain that pottery in the Pine Lawn Valley was introduced in the Pine Lawn Phase, and that phase has been dated (see Chapter XII) as extending from about 100 B.C. to about A.D. 500. Naturally, pottery did not reach these Mogollon Indians in driblets extending over 600 years. Pottery must have reached the area at a given moment—within the space of a year, perhaps. (4) And finally, a phase is thought by us to be an interval of time that may be characterized (arbitrarily) by a cluster of traits that are regarded as typical of that horizon. This is a portion of the continuum.

And so a phase to us may mean a moment, a span of centuries, a cluster of traits, or none of these; but rather, an endless moving belt of progress—a continuum.

In the section of this report devoted to Tularosa Cave we have assigned our materials to the conventionally named and well-known phases—Pine Lawn, Georgetown, San Francisco, Reserve, and Tularosa.

In that part pertaining to Cordova Cave we speak of a Pre-Pottery, a Plain Ware, and a Late Phase. We were forced to do this because (as is explained in Chapter III, "Pottery, Cordova Cave") we could not assign finer time divisions to the débris and the materials taken from it.

Then, for the purposes of clarity, let us state that we can equate the phases and horizons as follows: Pre-Pottery in Tularosa Cave is coeval with Pre-Pottery in Cordova Cave; the Pine Lawn and Georgetown phases of Tularosa, with the Plain Ware Phase of Cordova Cave; and the San Francisco, Reserve, and Tularosa phases of Tularosa Cave, with the Late Phase of Cordova Cave.

Further, when we state, as we do in the descriptive sections, in elliptic fashion—"Occurrence by phases" (for example, sandals): Pre-Pottery, 2; San Francisco, 1; San Francisco-through-Tularosa, 6—we would translate as follows:

1. That two sandals of a given type came from levels that are classified as having been laid down before the advent of pottery and that perhaps belong to the Chiricahua stage of the Cochise-Mogollon culture. We realize that there is no such thing as a "Pre-Pottery Phase," but for purposes of quick communication and consistency, we used this telegraphic notation.

2. That one sandal came from a level that was deposited or formed during the San Francisco Phase, as indicated by the presence of a "typical" constellation of pottery types of this phase—Mogollon Red-on-Brown, San Lorenzo Red-on-Brown, a sprinkling of Three Circle Red-on-White, Alma Plain, San Francisco Red, Alma Neck Banded, Alma Scored, Three Circle Neck Corrugated, Alma Incised, Reserve Smudged.

3. That six sandals came from a mixed level that contained pottery from San Francisco, Reserve, and Tularosa phases and that inasmuch as the level was mixed and contained typical wares of several phases and therefore could not be assigned to a particular phase, we considered the material as late. It is to be thought of "as early as the San Francisco Phase and perhaps as late as the Tularosa Phase."

In other words, a mixed level that cannot be pinned down to a particular phase will be indicated in this manner: "Georgetown-through-San Francisco," or "Pine Lawn-through-Georgetown," and the like.

Sometimes we may use the term "period" for "phase" and "phase" for "period." In this report, they are synonymous and usually convey a chronological significance, expressed or implied.

Level 1 is the surface of the midden—the top level.

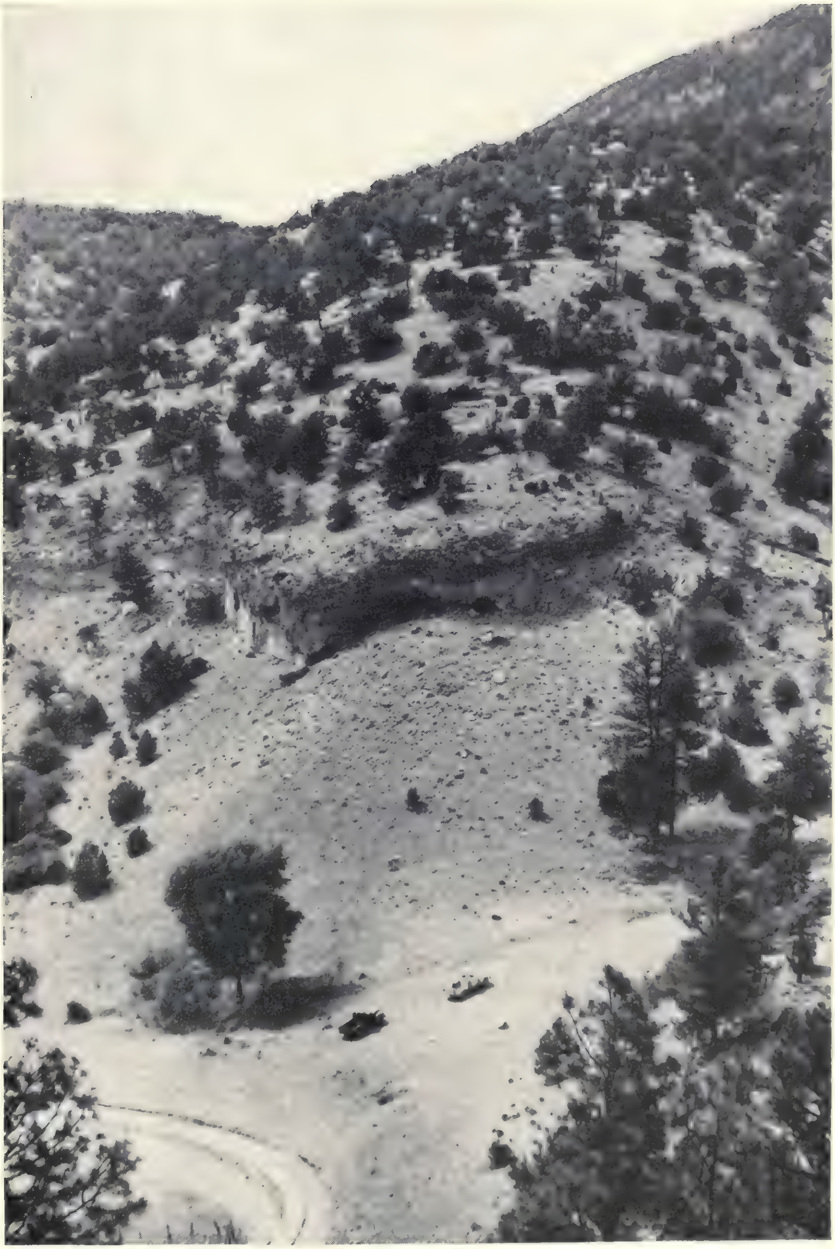


FIG. 2. Panoramic view of Tularosa Cave, looking north.

II. The Caves

Tularosa Cave

By JOHN B. RINALDO

Physical Description

Tularosa Cave (elevation 6,762 feet) is the largest of a series of small caves in a sandstone and conglomerate cliff (Fig. 2). It is situated in Section 9, T. 5 S., R. 16 W., and is more than one hundred feet above the Tularosa River, at the top of a steep talus slope on the north side of Tularosa Canyon (Fig. 3).

When first observed from the canyon floor below, the cave appears as a crevice in the cliff face, so well is the mouth hidden by an accumulation of very large boulders and débris that have fallen from the cliff overhang directly above. The surface of the slope below the cave is strewn with small and large rocks and is almost barren of vegetation, although adjacent to the cave on the ridge tops and the gentler slopes there are good stands of yellow pine, juniper, pinyon pine and live oak, as well as some sparse grass, cactus, poppy thistle and the like. By way of contrast with the talus slope, the valley floor is very green. The Tularosa River is a narrow, shallow stream where it passes below the cave, scarcely a mile downstream from its source. However, it provides sufficient water for the valley floor so that there is a stand of grass and clover on which the cattle graze. During the summers of 1949 and 1950 there were also two small fields in which crops of corn, beans, and sunflowers were grown.

Before excavation, the roof of the cave was so close to the surface of the midden heap that the cave could not be entered if one stood upright (Fig. 4); and the heap of boulders outside so blocked the sunlight that the interior of the cave was only dimly lighted.

The floor of the cave (Fig. 5), the surface of a dry midden littered with dung from modern use as a donkey corral, sloped from all sides to the center. Near the walls of the cave, but scattered at random,

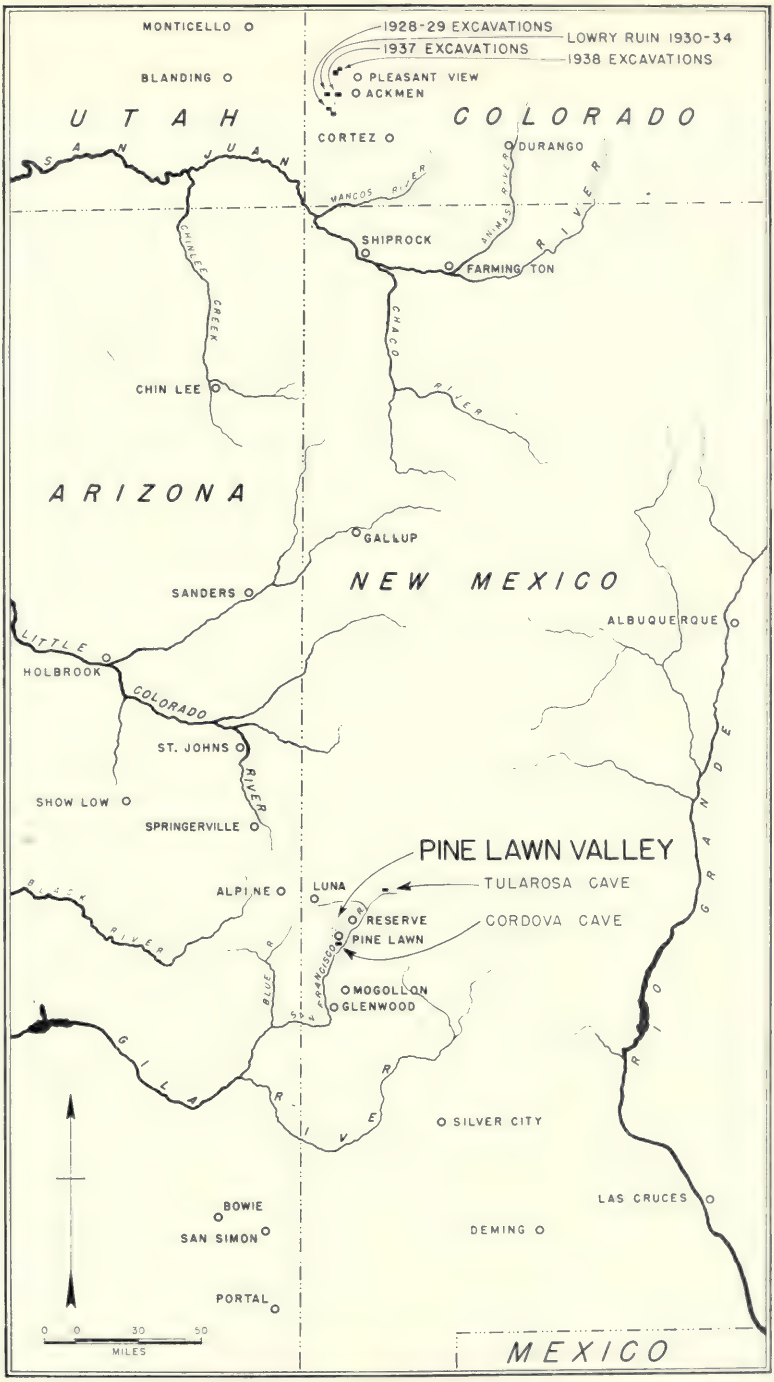

1928-29 EXCAVATIONS
LOWRY RUIN 1930-34
1937 EXCAVATIONS
1938 EXCAVATIONS
PLEASANT VIEW
ACKMEN
MONTICELLO
BLANDING
UTAH
COLORADO
CORTEZ
DURANGO
SAN JUAN
MANCOS RIVER
ANIMAS RIVER
RIVER
SHIPROCK
FARMINGTON
CHINLEE CREEK
CHACO RIVER
CHIN LEE
ARIZONA
GALLUP
NEW MEXICO
SANDERS
ALBUQUERQUE
LITTLE COLORADO
HOLBROOK
ST. JOHNS
RIVER
SHOW LOW
SPRINGERVILLE
PINE LAWN VALLEY
TULAROSA CAVE
CORDOVA CAVE
LUNA
RESERVE
PINE LAWN
ALPINE
BLACK RIVER
BLUE R
SAN FRANCISCO R
MOGOLLON
GLENWOOD
GILA RIVER
SILVER CITY
RIO GRANDE
LAS CRUCES
DEMING
BOWIE
SAN SIMON
PORTAL
0 0 30 50
MILES
MEXICO

Fig. 3. Map showing location of Tularosa and Cordova caves.

there were four relatively shallow pits left as the results of excavation by local curiosity seekers. On the east side of the cave, towards the back, a large boulder stood out some three feet above the surface of the midden.

Surface Indications

From the surface of the midden there were collected Mogollon Red-on-Brown and Tularosa Black-on-White potsherds, a small plaited sandal, a mano, a metate fragment and some corncobs. There was also evidence of the modern use of the cave in addition to the manure—fragments of a medicine bottle, scraps of calico, and a mule shoe.

In front of the mouth of the cave under the cliff overhang there were indications of a row of pueblo rooms; these consisted of several large slabs in alignment and next to the cave wall a fragment of masonry built of several courses of small flat stones in a thick adobe cushion. These rooms are illustrated by Hough (1907, Fig. 43, p. 75) on his survey map.

On the face of the cliff adjacent to the cave are a number of petroglyphs, a few of which are possibly of Indian origin. One is a terraced figure and another a many-legged creature resembling a centipede. They are much less distinct than the initials, dates, and other modern symbols made on the walls close by. Although Hough (1914, p. 4) categorically states that "no pictographs, or other artificial scarrings exist on the face of this cliff," it seems possible that they may have escaped his observation.

More petroglyphs were found beneath the midden on the south wall and near the mouth of the cave. These comprised two "figures," the outlines of which were made by a series of drilled holes; that is, holes drilled into the rock wall with a stone drill. With some imagination, one could "see" a long-legged bird such as a heron and a four-legged animal lying on its back with legs stretched upward. Since these were covered by refuse containing plain pottery, we assume that they were created in the Pine Lawn Phase or earlier.

A line of blackened holes, above the cave mouth, in the overhang are thought to have been holes for the roof beams of the rooms which once covered the mouth of the cave.

Other things have remained the same since Hough's visit and excavations; for example, the "splendid block of fine grained gray rock on whose surface are regular oval shallow pits in which stone

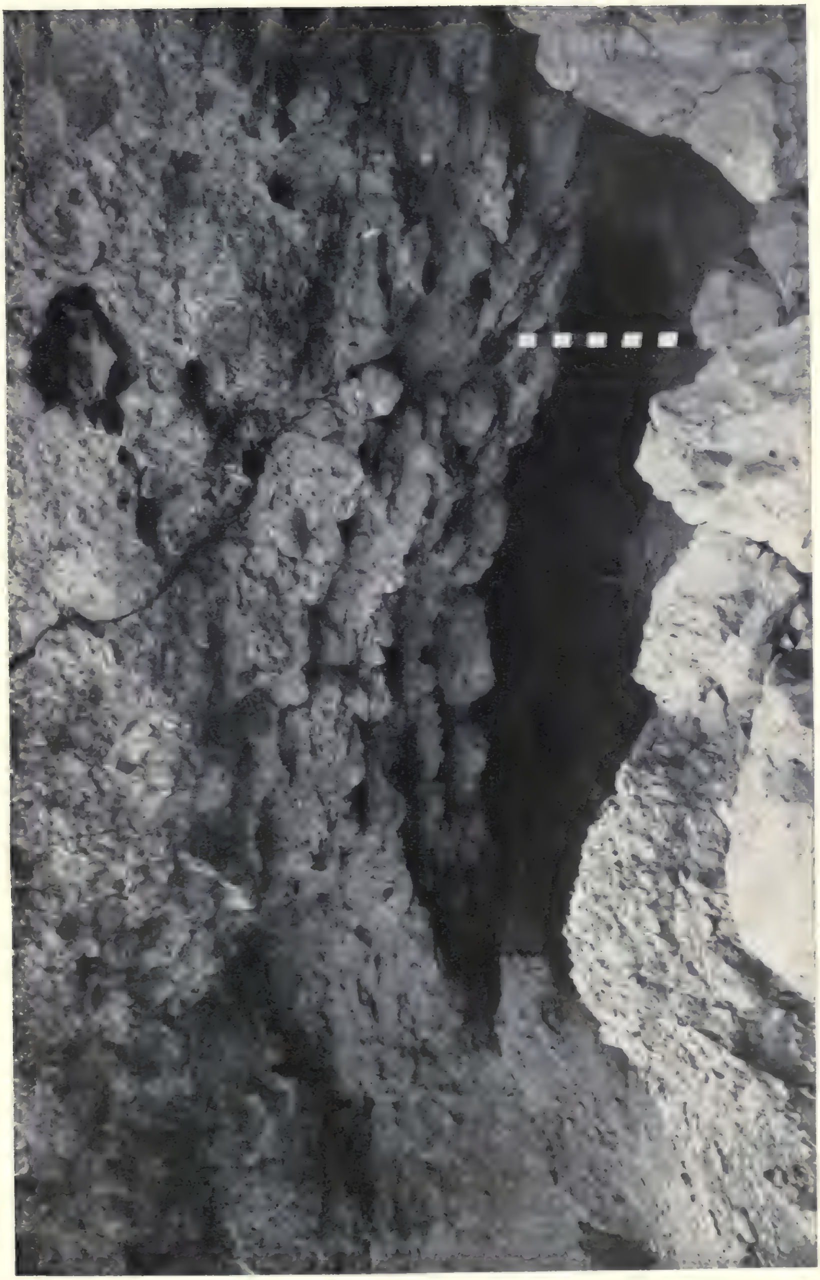


FIG. 4. The mouth of Tularosa Cave at start of excavation. Meter stick in foreground.

implements were sharpened" is still to be found at the west end of the cave entrance.

Another much smaller cave in the series, located on the west face of the cliff, is at least partly artificial. It has a T-shaped door, pockets in the floor, and other indications that it was excavated in the rock.

Floor Features

Twelve pits were encountered in the sandstone floor of the cave. They were mostly round and the walls were sometimes slightly undercut. The edges of two pits touched, forming a double pit. The diameters varied from 25 cm. to 1.25 meters, with an average diameter of about 54 cm. The depths varied from 17 cm. to 60 cm., with an average depth of about half a meter. Most of the pits were not truly round, although the variation in axis was only from 5 to 10 cm.

These pits were not arranged, so far as we could see, in any order. There were two groupings: one of five large pits located in the front part of the cave; and one of seven smaller pits in the west central portion of the cave floor.

None of the pits was plastered or lined with slabs (as were many Anasazi cave-pits). Most of them were filled with cave débris (ash, vegetal materials). The pits were probably used for storage of foods, because a few of them contained quantities of unhusked corn.

The pit in the floor of Square 5 contained a large coiled, twined grass basket with an oval lid (Chapter VI, Fig. 118). The basket was partially filled with unhusked corn.

In addition to the floor pits, we discovered four post-holes(?), with diameters and depths ranging from 8 cm. to 25 cm. Three of the post-holes were located close to the west group of storage pits, while the fourth was approximately in the center of the cave. The significance or function of the post-holes is unknown.

Digging Crew, Schedule, and Equipment

The field crew consisted of three or four local laborers, a student, a surveyor-photographer and myself. All tools, except the wheelbarrow, the large sieve, and the artifact boxes were brought from the camp house in the morning and were returned at night. A half-ton truck was used to transport workers and tools.

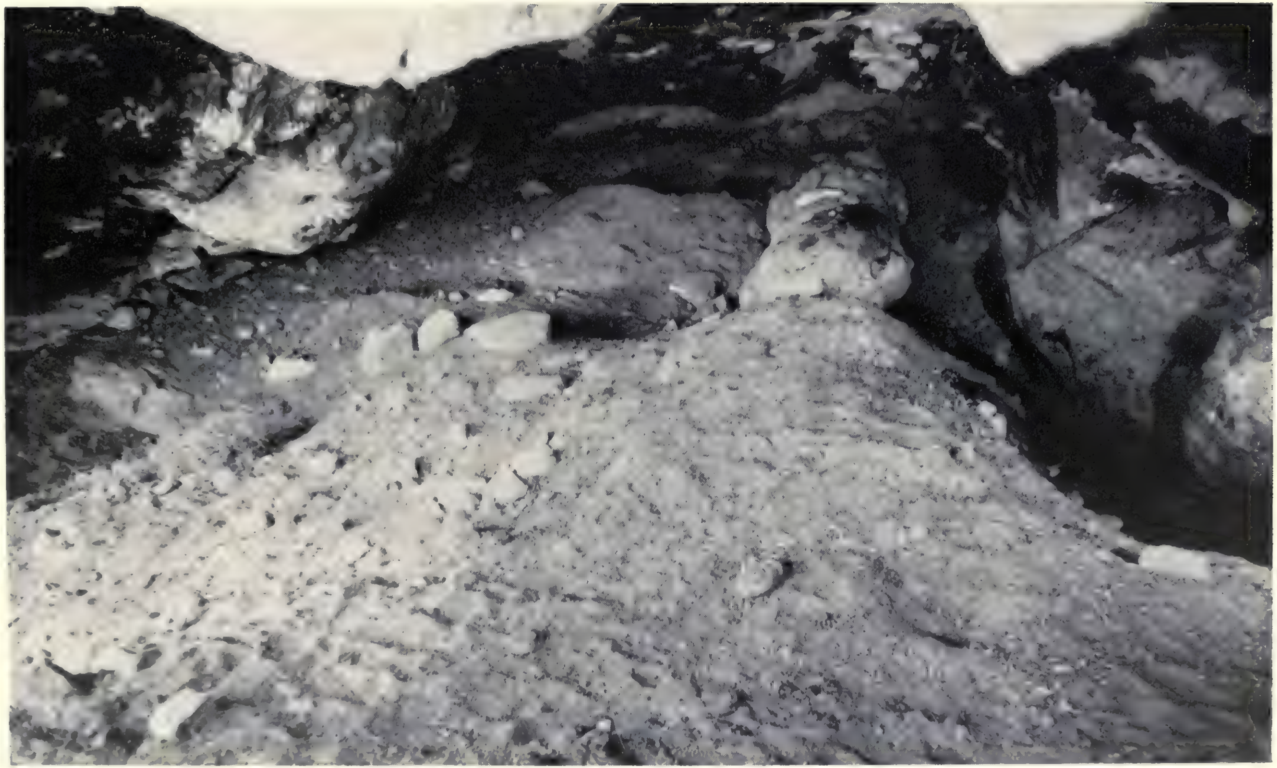


FIG. 5. The interior of Tularosa Cave before excavation.

In addition to the tools mentioned above, our principal tools were long-handled shovels, pointing trowels, whisk brooms, ice picks, and paint brushes. Occasional use was made of a heavy pick and a jack hammer in the breaking up and removal of large rocks. Sieves were of two sizes—a large, stationary, 3 x 6-foot sieve with quarter-inch mesh, and a small 18 x 20-inch sieve with sixteenth-inch mesh. The artifact and pottery boxes were fruit boxes made tight with a lining of muslin. Cultural materials sifted out on the screen were placed in these boxes and as each level of a particular square of the excavation was completed, they were sorted out into various sacks. The lighter vegetal materials and the small artifacts were put in separate paper sacks marked with the find spot of square and level; the unworked bone fragments and the cordage were put in other sacks. Heavy materials like pottery and some of the smaller stone artifacts (for example, rubbing stones and polishing stones) were placed in small gunny sacks and tagged with their find spots. The larger stone artifacts, such as metates and manos, were put in a special pile and either photographed and described on the spot or returned to the camp house in marked containers. Metates left on the spot were marked with a letter to facilitate comparison of the photograph and written description.

Rubber double respirator masks and goggles were worn by all the crew while digging or sieving operations were going on, as protection against the fine dry dust which floated in the air. Large portable flashlights with re-chargeable wet storage batteries and removable floodlight lenses were used for light in the darker areas of the cave.

A soil-testing tube was used occasionally to determine the depth of the midden at various points.

Digging Operations

Excavation started at the outer edge of the cave as close to the center of the mouth as possible, to avoid the large rocks and the disturbed areas near the walls. A trench two meters wide and divided into two-meter squares was laid out. This extended to the center of the back of the cave. Because of the uneven surface of the midden, the first level was excavated to a varying depth to achieve a fairly level floor so that subsequent levels would be of uniform thickness. On the other hand, the volume content in one of these first levels would probably not be much different from that of the lower levels because if at one side or end of the square the level

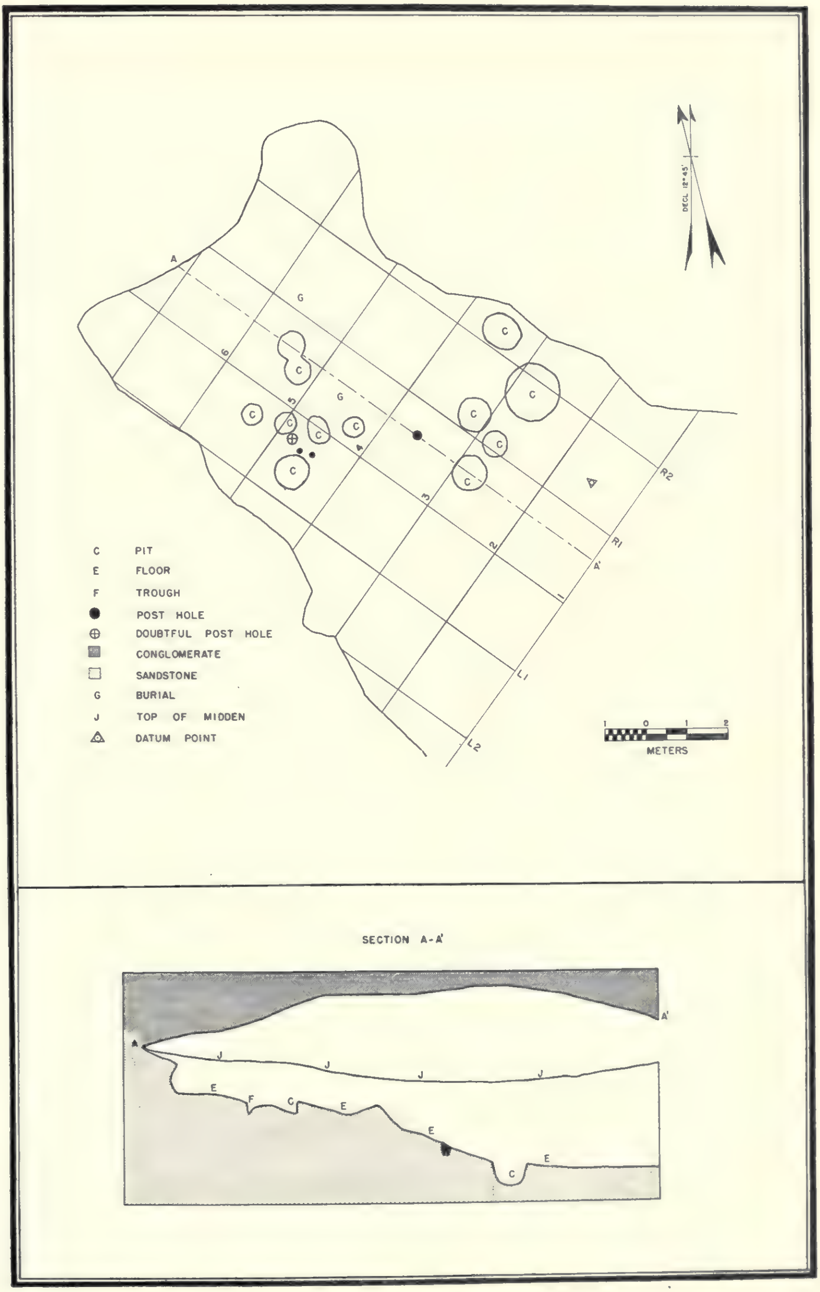

DECL 12°45'
A
A'
G
G
C
C
C
C
C
C
C
C
C
C
C
1
2
3
4
5
6
R1
R2
L1
L2
C PIT
E FLOOR
F TROUGH
● POST HOLE
⊕ DOUBTFUL POST HOLE
▨ CONGLOMERATE
☐ SANDSTONE
G BURIAL
J TOP OF MIDDEN
△ DATUM POINT
1 0 1 2
METERS
SECTION A-A'
A
A'
J
J
J
J
E
F
C
E
E
E
C

FIG. 6. Plan and section of Tularosa Cave.

would be shallow, at the other end it would be deep. All levels below the first level were 20 cm. thick. We continued to follow the same 2 x 2-meter-square stripping technique in the trenches on either side of the central trench. In some places, the débris extended downward for 14 levels (2.80 meters).

The grid of co-ordinates for these trenches was designated as follows: The squares were numbered from 1 to 6, starting at the mouth of the cave and proceeding toward the back. The squares to the right of the central trench (as one faced the rear of the cave) were designated with "R" numbers ("R" standing for "right"), such as 2R2. The squares to the left were given "L" numbers ("L" standing for "left"), such as 5L1. Thus, a sack of pottery coming out of the second square from the mouth of the cave—which was also the second square to the right of the axis trench—would be labeled as coming from SQ. 2R2 (Fig. 6).

The midden throughout was so soft and full of fibrous material that it could be shoveled without the use of a heavy pick. The usual practice was to trowel the débris off a vertical face and then shovel it into a wheelbarrow. Some artifacts and cultural material were separated at this time. The wheelbarrow was then pushed outside to the dump and the débris poured onto a rigid sieve where it was troweled through for the cultural material, which was put in the artifact boxes.

Square 1 was carried to a depth of only one level, at which point large boulders were encountered that were so wedged into one another that they could not be moved, and so digging was discontinued in that square. All other fifteen squares excavated were dug to bedrock and those adjacent to the wall were dug out to the wall. The areas next to the wall adjacent to Squares 4L1, 5L1, and 6L1 were shallow and so barren of cultural material that they were included with the first level of their respective adjacent squares. Thus, for example, the material between Square 5L1 and the cave wall, which—following the standard practice—would have been designated as from Square 5L2, was actually included in sacks containing material from Square 5L1.

Although there were no extensive strata in the cave there were two compact levels of limited extent, which were troweled off. Other features such as pits, burials, "post-holes," and the like were also cleared with trowel and whiskbroom, or ice pick and paintbrush. A fine-meshed sieve was used to sift the dust around the burials.

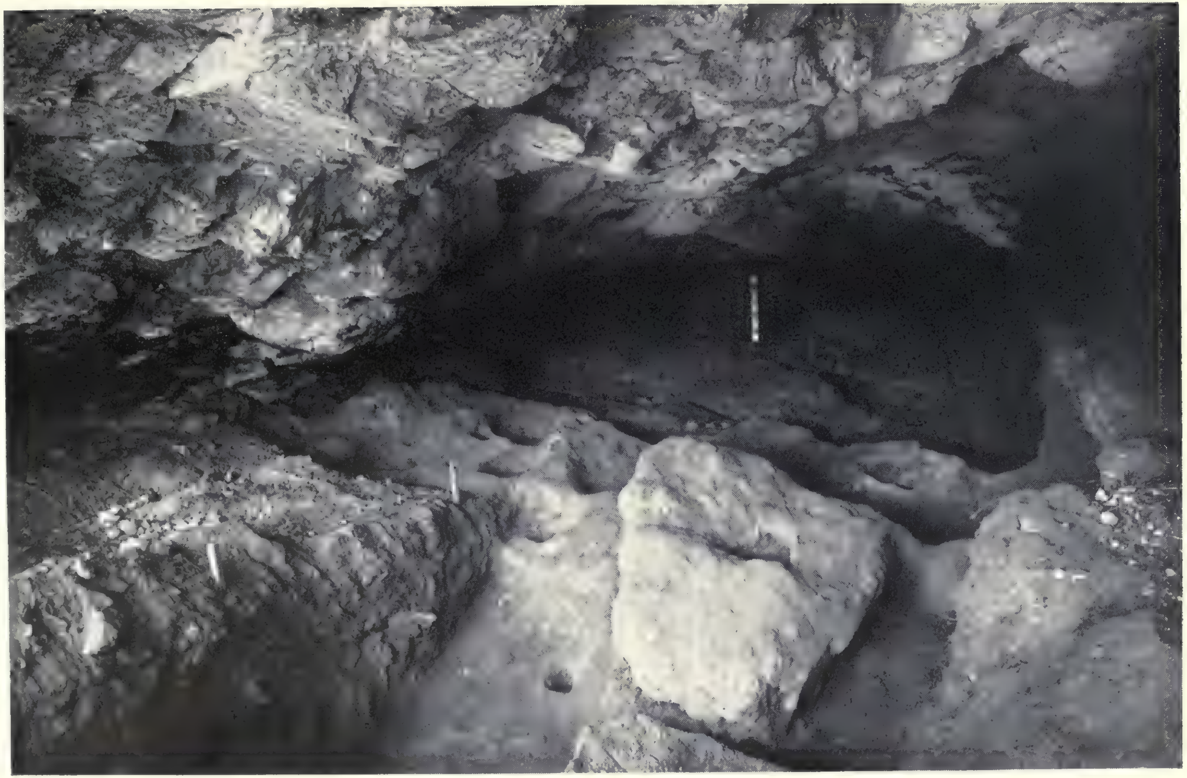


FIG. 7. The interior of Tularosa Cave after excavation. Arrow (50 cm. long) points north; meter stick in background.

Mapping and Photography

Such features as pits and burials were surveyed in by triangulation (Fig. 7). Datum points, bench marks and other points used in mapping the cave were scratched on the walls or roof of the cave, or were marked with stakes. A telescopic alidade, plane table and metric rod were used in this mapping.

Photographs were made using a 5 x 7-inch view camera, with double extension bellows, mounted on a metal tripod. Some use was made of a wide angle lens. Artificial lighting was furnished by a photo-flash gun with two additional reflectors and bulbs at the end of extension cords. Use was also made of flares. From about 11:00 A.M. to 1:30 P.M. on bright sunny days there was sufficient light in the outer half of the cave to take time-exposure photographs.

Cordova Cave

By PAUL S. MARTIN

Cordova Cave takes its name from the former owner of the ranch that was located below the cave. The cave is in Section 4, T. 8 S., R. 19 W., N.M.P.M., and the elevation is about 6,840 feet.

The cave can not be seen from the valley below, partly because it is about 1,000 feet above the San Francisco River and partly because a ridge and trees screen the entrance from view unless one is very close to the cave (Fig. 8).

To reach this site, a zigzag trail was constructed so that saddle horses could be ridden daily back and forth to the cave. Because the site was not easily accessible and because there was no water available, we decided that it was more feasible to repair to the cave each day rather than to camp there. Even this was not an easy feat, since feeding, watering, and saddling the horses required some time twice a day and the ride required about 45 minutes on a stiff grade. The digging day was somewhat short, perforce.

Cordova Cave is located in a sandstone-conglomerate cliff and is probably the result of wind erosion. The mouth of the cave is irregular but more or less oval in shape, about 3 meters high and 4 meters wide. The surface of the cave débris was made up of gravel (probably spalled from the roof) and bat dung. The roof and entrance were smoke-blackened.

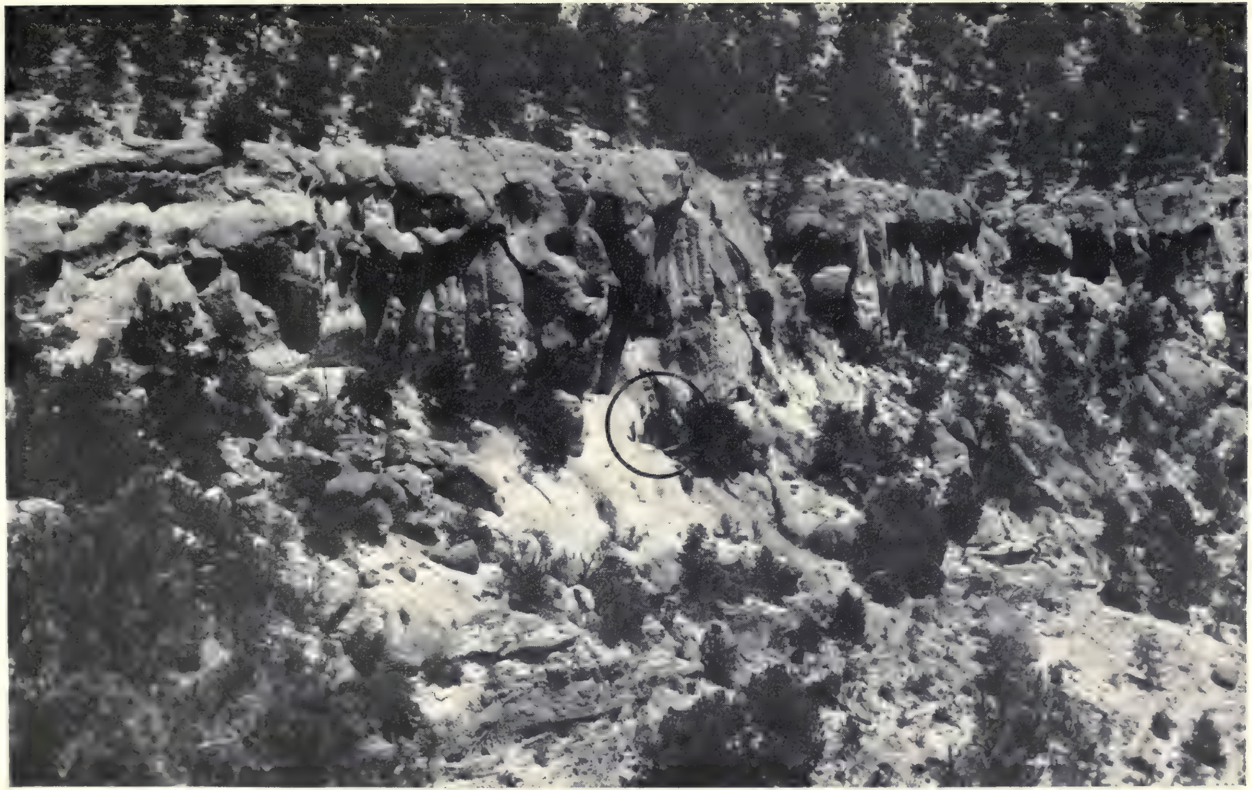


FIG. 8. View of cliff in which Cordova Cave is located (cave entrance within circle).

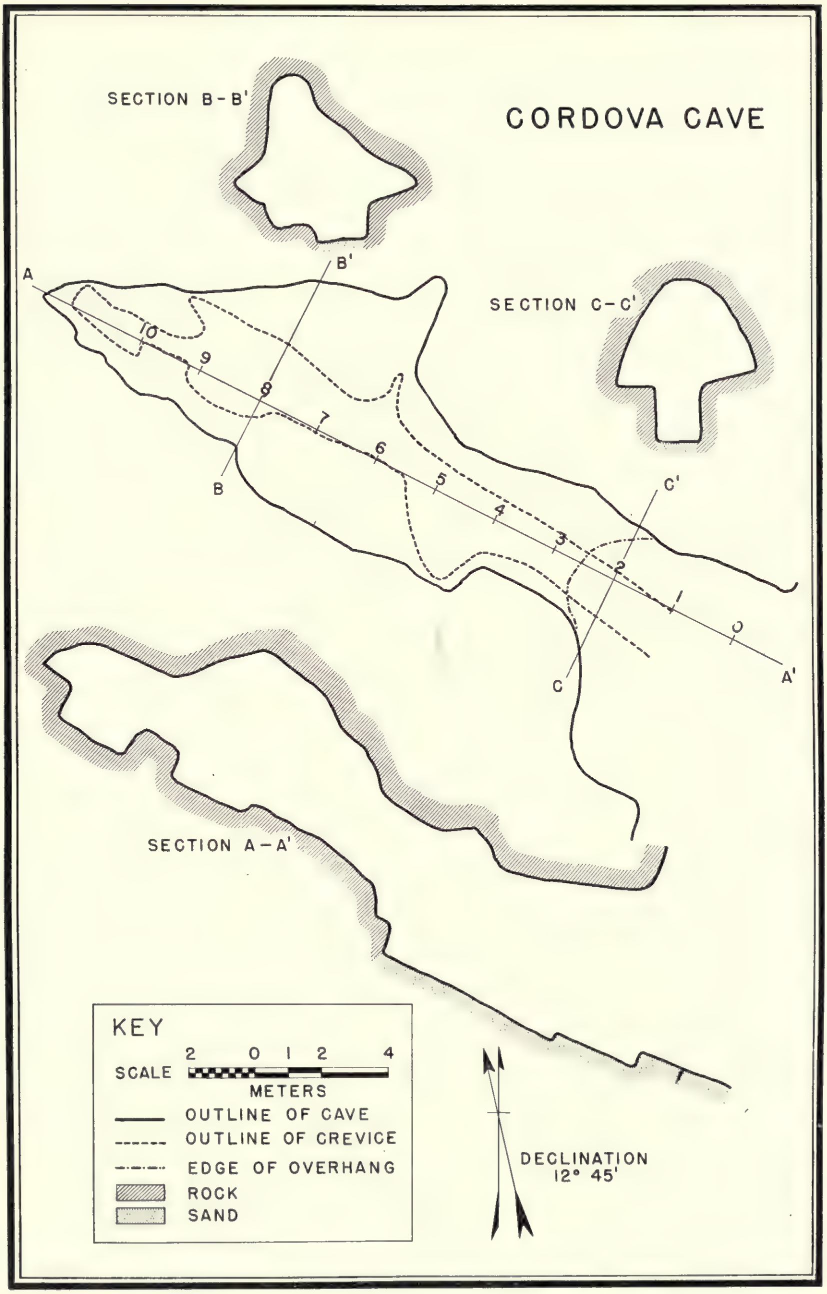

CORDOVA CAVE
SECTION B-B'
SECTION C-C'
SECTION A-A'
A
B'
B
C'
C
A'
10
9
8
7
6
5
4
3
2
1
0
KEY
SCALE
2 0 1 2 4
METERS
OUTLINE OF CAVE
OUTLINE OF CREVICE
EDGE OF OVERHANG
ROCK
SAND
DECLINATION
12° 45'

FIG. 9. Plan and sections of Cordova Cave.

The lower slope of the high ridge in which Cordova Cave is located is sparsely covered with Ponderosa pine, some juniper, live oak, and pinyon. Higher up, the slope holds less soil or is actually made up of great boulders or great stretches of bare rock. Here the vegetation is sparse, consisting mostly of grass, cactus, and rabbit brush.

The view from the cave is eastward toward the Tularosa Mountains as well as up and down (north and south) the San Francisco River Valley for several miles. After the rains start, the valley is a deep green and is always a superb spectacle, with ever-changing lights and shades.

After excavations were completed, we found the cave floor was extremely irregular (Fig. 9). The floor was divided by a deep crevice (about 1.5 meters to 3 meters wide and 1 meter to 3 meters deep (Figs. 10–12). In addition to this large crevice that extended from front to back of the cave, there were other bumps and humps and irregularities. There were no pits or post-holes.

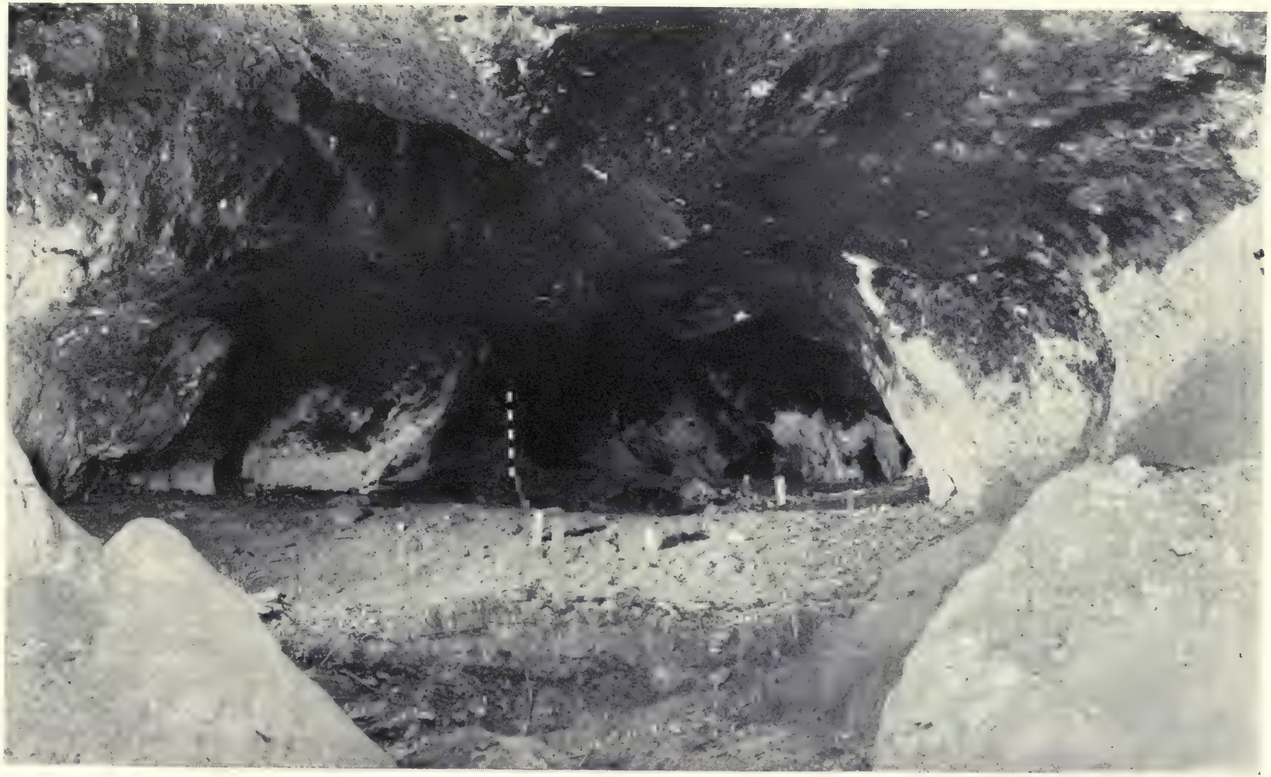


FIG. 10. Mouth of Cordova Cave at start of excavations. Meter stick in background.

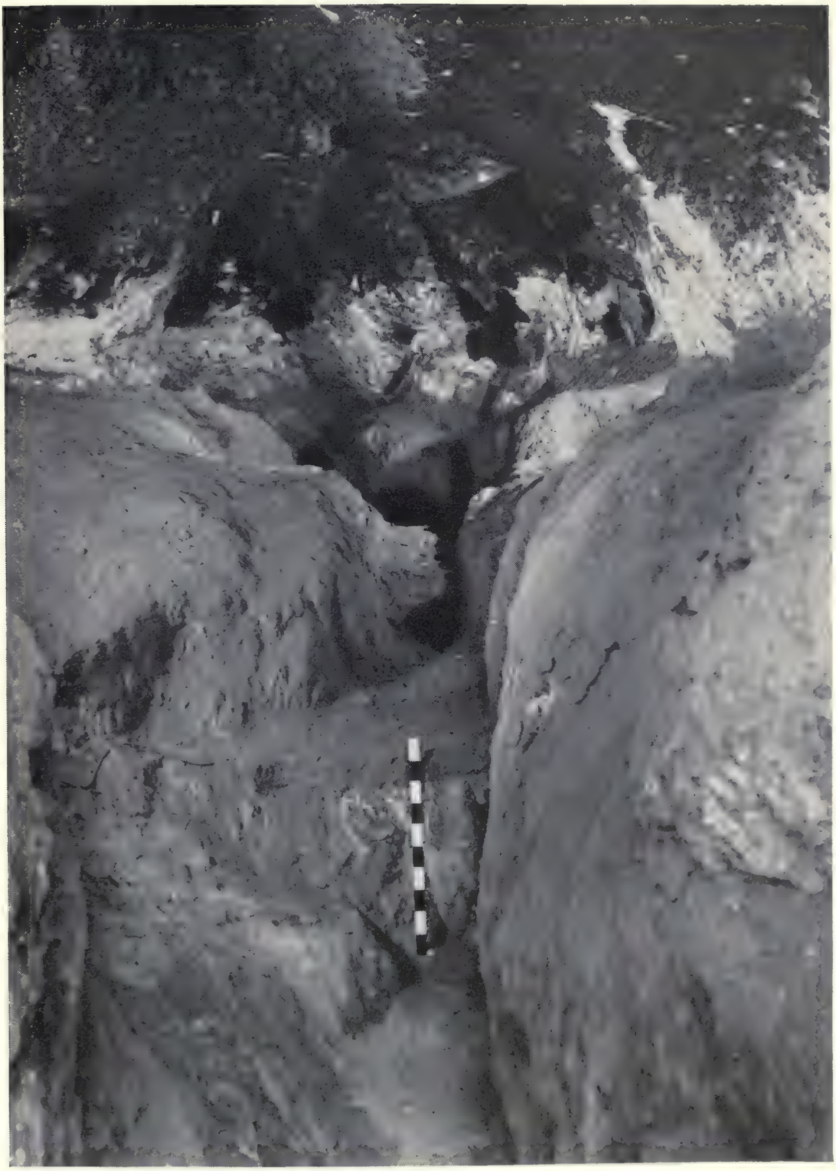


FIG. 11. Entrance of Cordova Cave after excavations, showing crevice. Meter stick in foreground.

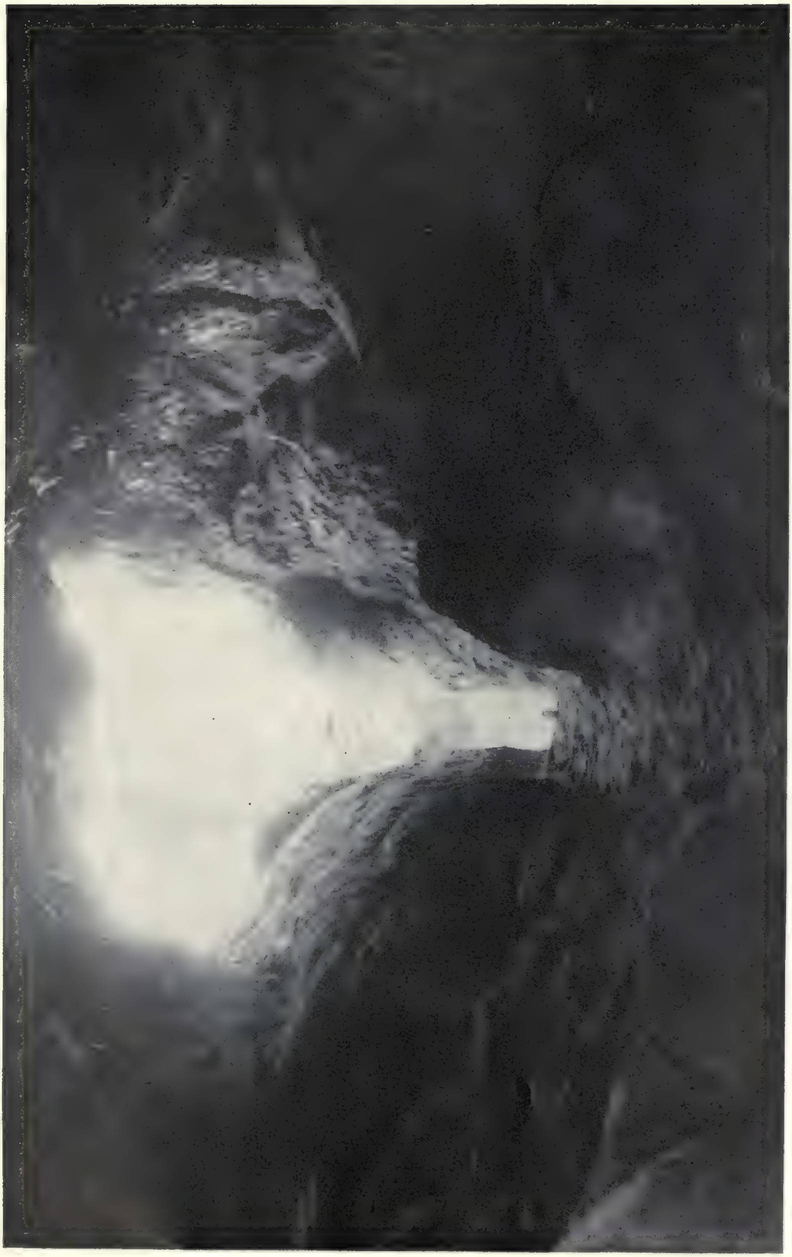


FIG. 12. Cordova Cave, looking outward, showing crevice.

III. Pottery

By John B. Rinaldo

Tularosa Cave

Pottery was recovered from the majority of levels excavated in Tularosa Cave, some sherds coming from as deep as 2 meters below the surface of the midden. In all, 5,710 potsherds and six whole or restorable vessels were secured. Together these collections comprise a synoptical series of all the known native types in the Upper Gila Drainage from the beginning of pottery-making up to the early part of the Tularosa Phase. The proportions of the types in this long stratigraphic series provide good evidence of the validity of the sequence that was previously outlined on the basis of several much shorter overlapping series, and on the seriation of pottery type frequencies from individual houses and rooms. Thus it is of importance not only to the history of developments within the cave, but also to the same developments in the wider surrounding area.

In this chapter the pottery will be described first as a complete body of material, and then by phases under the headings "Painted" and "Plain." In addition to this description there will be presented a tabulation of frequencies and percentages of all pottery types from selected squares and levels excavated; and a chart showing the relationship of the principal pottery types of the Upper Gila drainage as reflected in the cave series.

Method of Excavation and Analysis

The pottery from the cave was excavated according to the standard stripping technique of squares and levels (see Chapter II). All material excavated from the cave was screened with a trowel over a sieve with quarter-inch mesh, and therefore the counts included herein are only for sherds with larger than quarter-inch dimensions. After the sherds were sorted out from the rest of the cultural material they were put into separate small gunny sacks, tagged according to square and level, taken back to expedition headquarters, and washed, sorted, and counted. The majority of the plain ware sherds were then discarded. The textured and painted decorated wares and a sample of the plain wares were put into paper sacks marked with their find-spots, and then returned to the Museum for further study.

In the Museum each sherd was then labeled as to square and level and all sherds of one type from the cave were compared directly with each other and with type sherds and vessels in the Museum collections as well as with the published descriptions. Errors in the field classification were corrected at this time and notes made on the more outstanding pottery characteristics.

Construction Techniques

Oxidizing firing was encountered in 97 per cent of all sherds and vessels recovered, reducing firing in only 3 per cent. All of the pottery was manufactured by the coil-scrape technique.

Occurrence by Cultural Subdivision

The majority of the pottery recovered from the cave was classified as belonging in the Mogollon Brown Ware series (97 per cent). Little more than 3 per cent could be classified as Anasazi types. These latter types are represented by both black-on-white trade pieces such as White Mound and Kiatuthlanna Black-on-White sherds of the Chaco Series, and the supposedly native types such as Reserve and Tularosa Black-on-White. Thus there is represented in the cave the Mimbres Branch of the Mogollon Root, trade with the Chaco Branch of the Anasazi Root, and a fusion resulting therefrom in this area which we term the Cibola Branch. One sherd tentatively classed as Hohokam was recovered.

Pottery Shapes

From a study of rims, neck sherds and the restored vessels it is evident that the jar form was the most common shape used for the textured wares and the plain wares, with the bowl form as the second most common shape. No sherds of textured or plain ware pitchers were collected.

Bowls and pitchers were the most common shapes for the painted decorated vessels, with jars only slightly less common. Bowls were the most common Mogollon Red-on-Brown shape. Pitchers were the most common shape for Tularosa Black-on-White and Reserve Black-on-White.

Occurrence by Levels and Phases

No pottery was recovered from the lowest levels of the deeper sections of the cave. The lowest levels of other sections of the cave contained six sherds or less of a variety of types, usually plain ware types. It was thought that these occurred as the result of the mixing and churning of the loose dust in the cave by the activities of the later inhabitants and the burrowing of rodents. Such levels were also classified as Pre-Pottery. Such mixture was found to a greater or less degree throughout all the pottery-bearing strata, so that occasionally a sherd or two of Reserve Indented Corrugated was found in one of the lower levels and Mogollon Red-on-Brown occurred in the top levels, which had a high proportion of Tularosa Phase pottery. On the other hand the differences in the proportions of the various pottery types at the different levels were sufficiently marked to be noticeable, even before they were tabulated as percentages or plotted on a graph.

After the percentages of each pottery type in each square and level were calculated, they were plotted by squares on a wedge-bar type graph with the percentages for the lowest levels at the bottom and those for the highest levels at the top (Fig. 13). From this graph the following conclusions were reached: (1) The frequency of textured pottery increased from the lower levels to the higher levels. (2) The frequency of Alma Plain and San Francisco Red decreased from the lower levels to the higher levels. (3) The proportion of Reserve Smudged increased from the earlier levels to the later levels. (4) The frequency of black-on-white pottery increased from the lower levels to the higher levels.

The classification of the various levels as to phase was done on the basis of these varying proportions of pottery types by comparison with the frequency of pottery types in the open sites and the deeper stratigraphic columns in the cave. For example, Square 3R1, Level 4, was classified as a San Francisco Phase block because 5.8 per cent of the pottery in that block was Mogollon Red-on-Brown, one of the diagnostic types of that period, and because it occurred there in a typical frequency (Table 1; Fig. 13). This percentage is very similar to that from Pit-house D, Starkweather, a typical house of the San Francisco Phase (Nesbitt, 1938, Table II, p. 87) in which 6.2 per cent of the pottery was Mogollon Red-on-Brown. More-

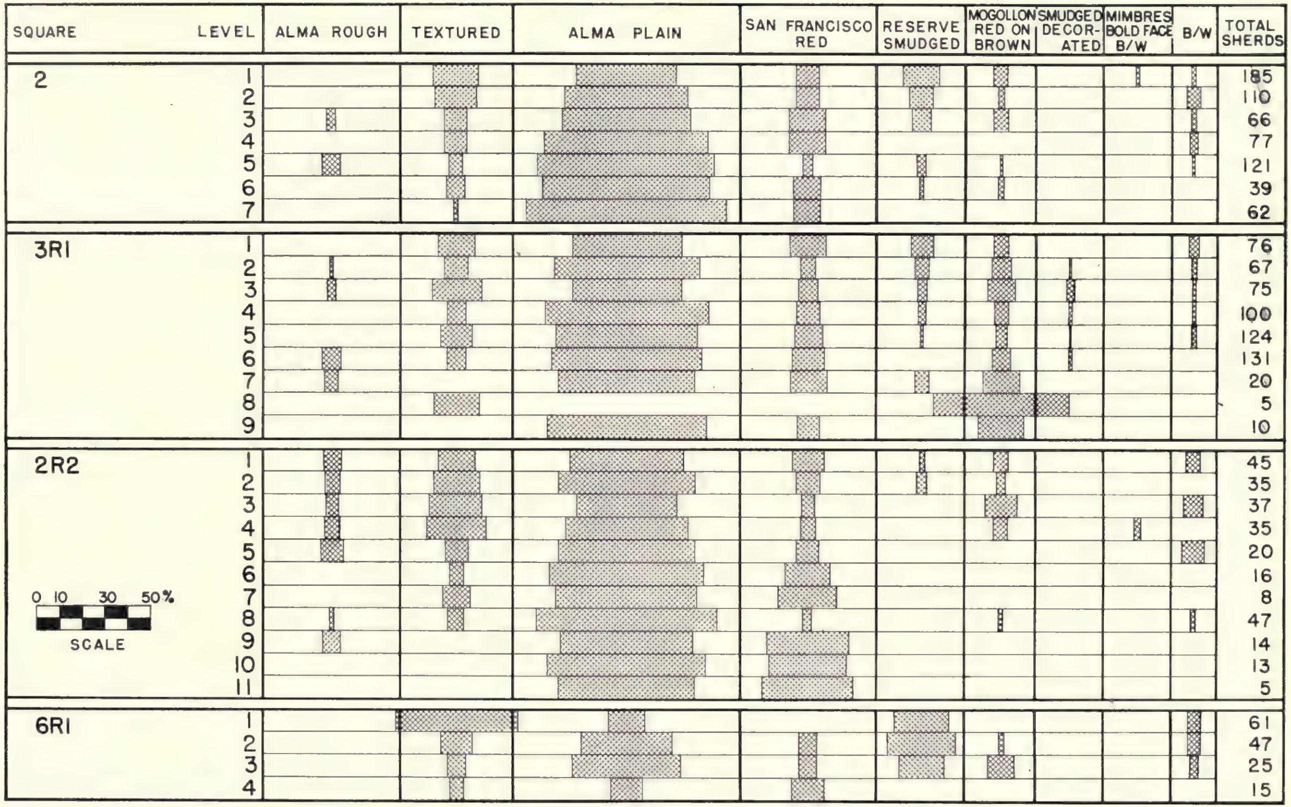


FIG. 13. Chart showing relationships of principal pottery types by squares and levels in Tularosa Cave.

over, the other pottery types characteristic of the San Francisco Phase also occurred in this block in typical frequencies: Alma Neck Banded and other early textured types were present and constituted the majority of the textured types, although altogether a small percentage, because textured types were still not very popular at this period. Then the ratio of San Francisco Red to Reserve Smudged is also typical for these two companion types at this stage in their development, for there is a relatively high proportion of San Francisco Red and a small proportion of Reserve Smudged. Reserve Smudged is not absent or very scarce as it is during the Georgetown Phase, nor does it exceed San Francisco Red in quantity as it so frequently does during the Reserve Phase. Moreover, the majority of the pottery from this block was Alma Plain, which in frequency (70.5 per cent) is also very similar to that from Pit-house D, Starkweather (73.4 per cent). Finally, the only black-on-white type present was La Plata Black-on-White, a type probably traded in, and typical of the corresponding period in the north. Reserve Black-on-White and other characteristic types of the Reserve Phase were absent, or very scarce. In general, this same sort of analysis was performed for all the blocks excavated.

In a level of the Pine Lawn Phase only the plain wares—Alma Rough, Alma Plain and San Francisco Red—were found. Within the Georgetown Phase levels the proportion of Alma Plain is larger and the proportion of San Francisco Red not quite as large. There is also usually a small percentage of textured pottery. In succeeding levels the proportion of textured wares increases while the proportion of Alma Plain decreases. This development in the textured wares and plain wares in addition to the increase of Mogollon Red-on-Brown and the presence of small quantities of early black-on-white types such as La Plata Black-on-White and White Mound Black-on-White mark the San Francisco Phase. Also, Reserve Smudged begins to assume the frequency that San Francisco Red had shown in the lower levels. We recovered very few sherds of Three Circle Red-on-White, or Three Circle Neck Corrugated, and therefore we assume that there was no occupation of the cave during the Three Circle Phase. On the other hand the uppermost levels in the cave frequently contained the same types as those found in the San Francisco Phase levels—Textured, Alma Plain, San Francisco Red, Reserve Smudged and Mogollon Red-on-Brown—but in quite different proportions and with other additions and changes; for example, there is also a larger proportion of indented corrugated in the textured wares, and Alma Neck Banded pottery is lacking. Tularosa Fillet Rim and Reserve Fillet Rim appear with the Reserve Smudged and assume some importance, and there are a few sherds of black-on-red types.

Notes on Pottery Types by Phases

POTTERY OF THE PINE LAWN PHASE

A. *Painted Wares.* Painted pottery does not occur in the Pine Lawn Phase.

B. *Plain Wares.* The characteristic plain wares are:

(1) Alma Plain (Haury, 1936b, p. 32; Martin and Rinaldo, 1947, pp. 362–368). Vessel shapes: Wide-mouthed jars, hemispherical bowls, globular jars without neck. Remarks: Fire clouding is unusually common in the Tularosa Cave collection; 3,012 sherds of this type were recovered from the cave.

(2) Alma Rough (Martin, 1940, pp. 78–80, and 1943, p. 238; Martin and Rinaldo, 1947, pp. 362–368). Vessel shapes: Hemispherical bowls, wide- and narrow-mouthed jars. Remarks: This pottery was scarce in the collection from the cave, partly because there were so few levels of the Pine Lawn Phase excavated; 96 sherds of this type were recovered from the cave.

(3) San Francisco Red, Saliz Variety (Martin, 1940, pp. 80–81, and 1943, p. 240; Martin and Rinaldo, 1947, pp. 364–368). Vessel shapes: Narrow-mouthed jars, hemispherical bowls, globular jars without neck (Fig. 14). Remarks: 616 sherds of this type were recovered from the cave.

There are no significant details to add to the published descriptions cited above. Although other vessel forms occur, these listed above are the only ones that we have evidence of from the cave.

POTTERY OF THE GEORGETOWN PHASE

A. *Painted Wares.* A broad line red-on-brown decorated type possibly may be assigned to this phase (Haury, 1936b, p. 9, footnote). However, the red-on-brown sherds from the levels which were classified as Georgetown Phase do not correspond to Haury's description of this early type. Instead, they have been classified as Mogollon Red-on-Brown (for description see "Pottery of San Francisco Phase," p. 58). Twenty-four Mogollon Red-on-Brown sherds were recovered from Georgetown Phase levels in the cave.

B. *Plain and Textured Wares.* The characteristic plain and textured wares of the Georgetown Phase are:

(1) Alma Plain (Haury, 1936b; Martin, 1940, 1943; Martin and Rinaldo, 1947).

(2) Alma Rough (Martin, 1940, 1943; Martin and Rinaldo, 1947).

(3) San Francisco Red (Haury, 1936b, pp. 28–31). San Francisco Red, Saliz Variety (Martin, 1940, 1943; Martin and Rinaldo, 1947).

(4) Alma Neck Banded (Haury, 1936b, p. 35). Vessel shapes: Wide-mouthed jars only. Remarks: Banded necks in which the lines between the coils are well defined are much more common in the Tularosa Cave collection than those in which the direct trace

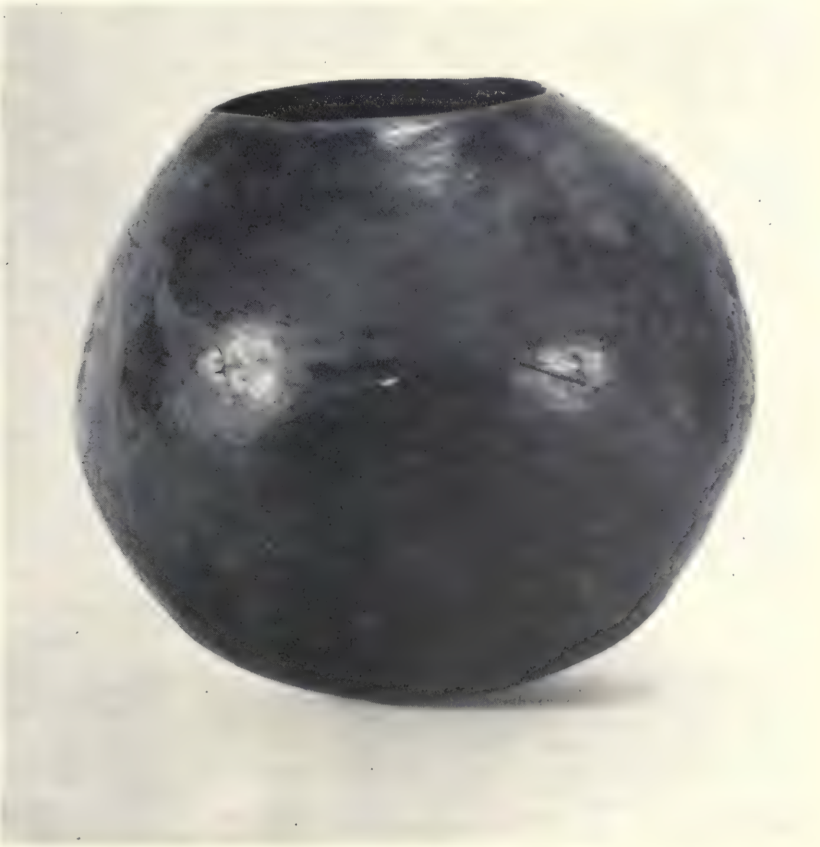


FIG. 14. San Francisco Red pottery jar, from Square 2R2, Level 10, Tularosa Cave. Height, 26.0 cm.

of the coils has been largely obliterated by polishing. Twenty-six sherds of this type were recovered from the cave.

(5) Alma Scored (Haury, 1936b, p. 38; Martin and Rinaldo, 1950a, p. 359). Vessel shapes: Wide-mouthed jars, bowls(?). Remarks: Some body sherds of this type from the cave were scored in the same manner as the neck sherds. Such scored body sherds are rare in the collections from the open sites in the Pine Lawn Valley. Twenty sherds of Alma Scored were recovered from the cave.

(6) Occasional sherds of Reserve Smudged were recovered from Georgetown Phase levels. Because Haury has suggested (1936b, p. 32; 1940, pp. 87–88) that smudging had its beginning in the Georgetown Phase, the question arose as to whether this occurrence was a positive association due to actual use in that level, or a negative association due to chance circumstances. Its absence from the pottery complex of the single Georgetown house excavated at Turkey Foot Ridge (Martin and Rinaldo, 1950a, p. 381) gave some slight evidence that it could be a chance association. To answer this question the association of Reserve Smudged in Georgetown Phase levels of the cave was checked by use of the standard formula in tests of association (see Lehmer, 1950, p. 417). It was found that the actual frequency of Reserve Smudged sherds in the Georgetown Phase (36 sherds), was less than the expected frequency (57 sherds) and that therefore the association was a negative one, or a chance association.

The types listed correspond in all details to the complete descriptions given in the sources cited above.

POTTERY OF THE SAN FRANCISCO PHASE

A. *Painted Wares.* The characteristic painted wares of the San Francisco Phase are as follows:

(1) Mogollon Red-on-Brown (Haury, 1936b, pp. 10–17; Martin and Rinaldo, 1950a, pp. 362–369; Nesbitt, 1938, p. 137). Vessel shapes: Bowls, wide-mouthed jars, seed bowls. Design elements (Fig. 15): 240 sherds with medium parallel lines, 58 with solid triangles bordered by parallel lines, ten with pennants, two with sawteeth, were recovered. No ticked triangle designs or sawtooth edges were recovered. Remarks: A light brown background color is much more prevalent in the cave collection than in the Mogollon Red-on-Brown sherds from open sites such as Turkey Foot Ridge. Three hundred sherds of this type were recovered from the cave.

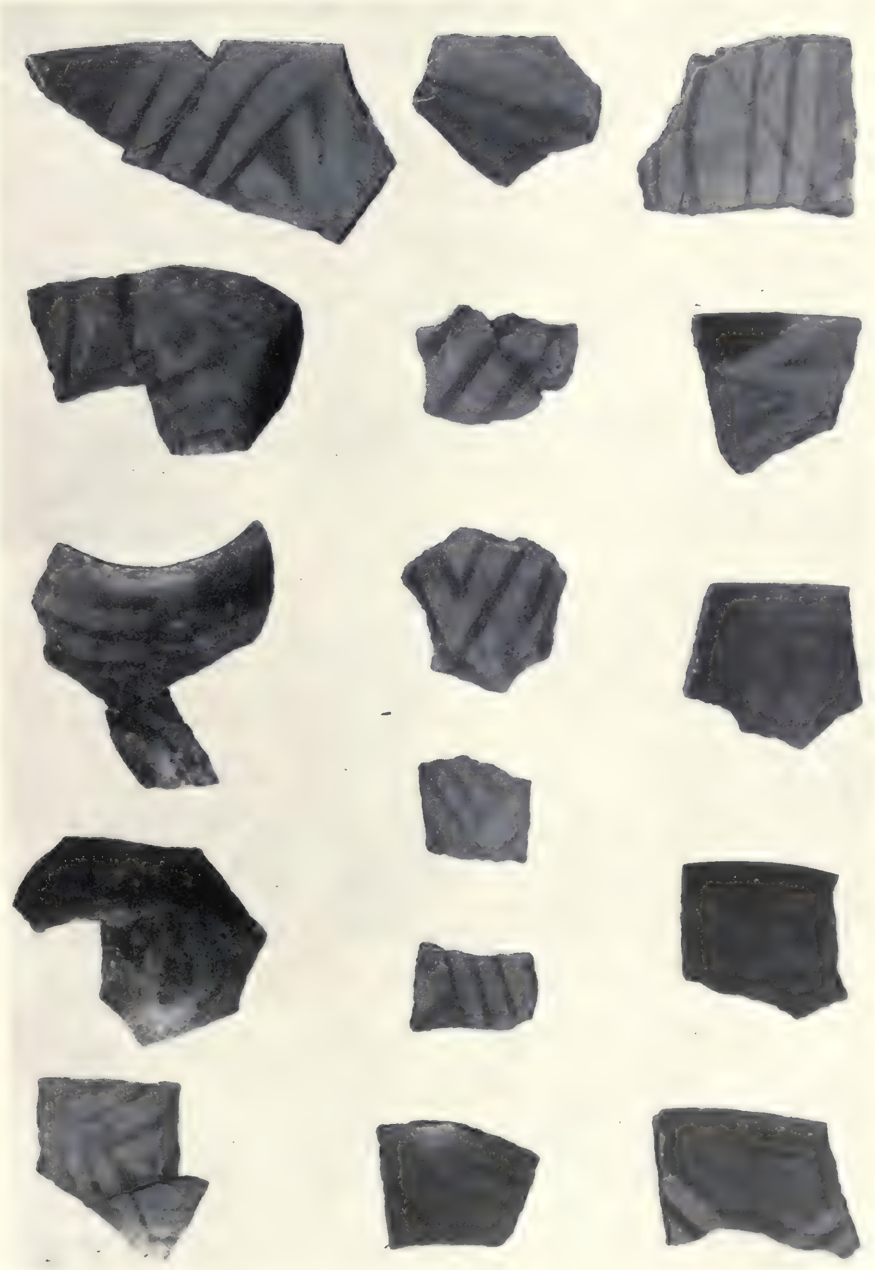


FIG. 15. Mogollon Red-on-Brown potsherds.

(2) San Lorenzo Red-on-Brown (Haury, 1936b, pp. 6–9; Martin and Rinaldo, 1950a, p. 368). Vessel shapes: Bowls only. Designs: Only broad line elements recovered. Remarks: This is a rare type in the Upper Gila area; only five sherds were recovered from the cave.

(3) Three Circle Red-on-White (Haury, 1936b, pp. 18–21; Martin and Rinaldo, 1950a, pp. 362–369; Nesbitt, 1938, p. 137). Vessel shapes: Bowls. Remarks: Only eight sherds of this type were recovered from the cave. Inasmuch as sherds of Three Circle Neck Corrugated were also very rare, it seems probable that this scarcity is due to the fact that there was no Three Circle Phase occupation of the cave.

B. *Plain and Textured Wares.* The eight principal types are:

(1) Alma Plain.

(2) Alma Rough.

(3) San Francisco Red.

(4) Alma Neck Banded.

(5) Alma Scored.

References to descriptions of these types and notes on them will be found above under the descriptions of pottery types of Georgetown Phase.

(6) Three Circle Neck Corrugated (Haury, 1936b, pp. 36–37), four sherds.

(7) Alma Incised (Haury, 1936b, p. 40), two sherds.

(8) Reserve Smudged (Martin, Rinaldo and Antevs, 1949, pp. 187–188; Martin and Rinaldo, 1950a, pp. 359–360, 1950b, pp. 500, 534). Vessel shapes: Bowls. Remarks: This type had its beginnings in the San Francisco Phase, if not earlier. Of this type 504 sherds were recovered from the cave, 211 of which came from San Francisco Phase levels.

POTTERY OF THE RESERVE PHASE

A. *Painted Wares.* The principal types are:

(1) Reserve Black-on-White (Nesbitt, 1938, p. 138; Martin and Rinaldo, 1950b, pp. 502–519). Vessel shapes: Pitchers, bowls, narrow-mouthed jars. Design elements (Fig. 16): Three sherds with solid oblique sawteeth, one sherd with terrace, two with solid and hatched broad lines, ten with diagonal hatch, one with cross hatch, one with solid and hatched scroll, one with turkey track, one with

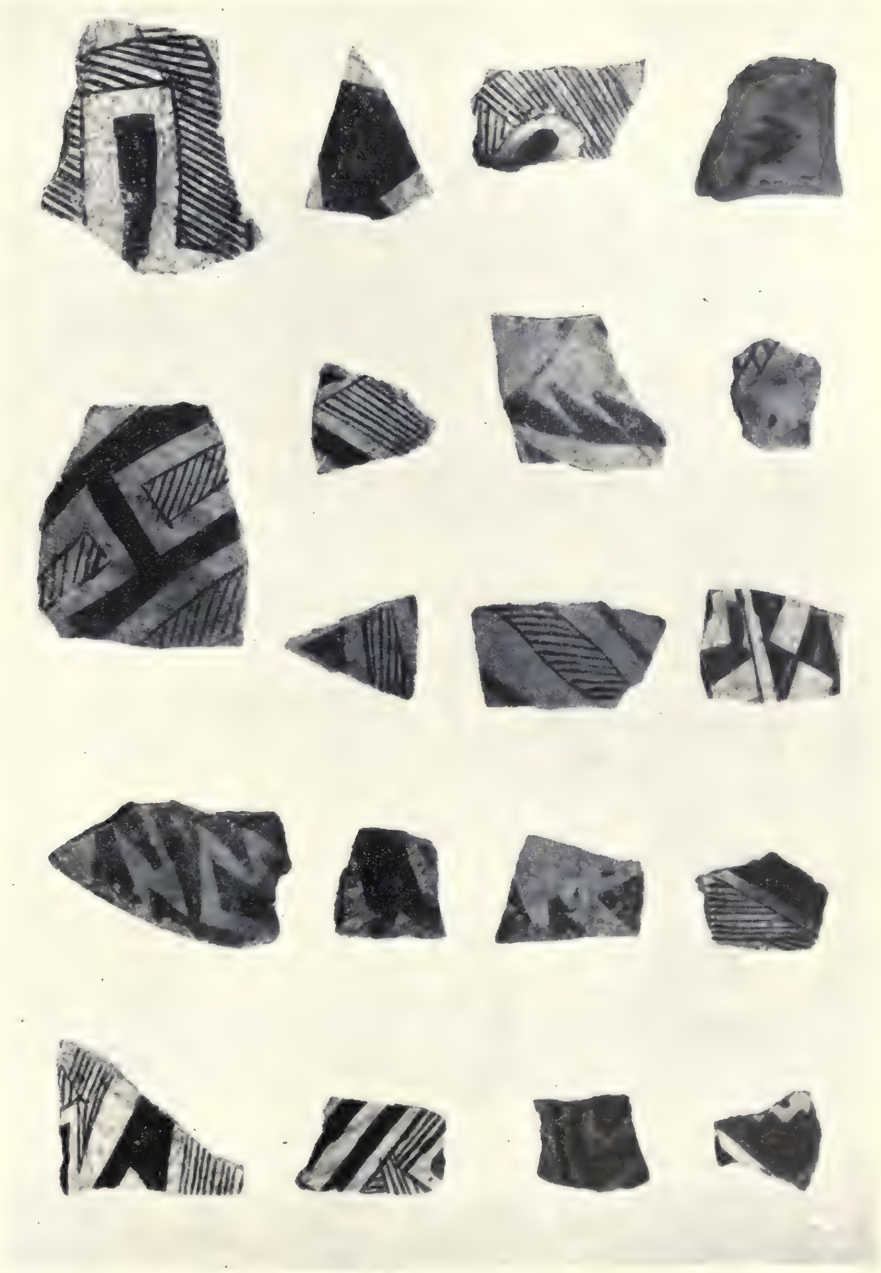


FIG. 16. Reserve Black-on-White potsherds.

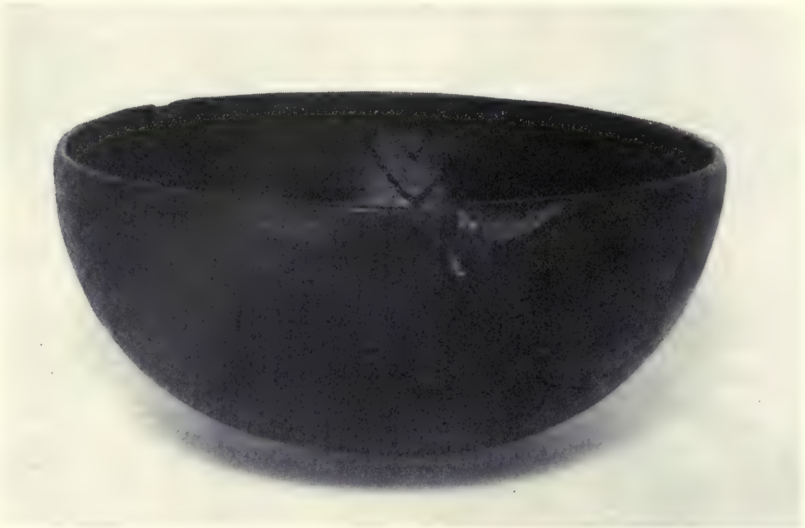


FIG. 17. Smudged Decorated pottery bowl, from Square 6, Level 2, Tularosa Cave. Diameter, 22.0 cm.

solid and hatched oblique sawteeth, two with medium line, two with checkerboard of diamond shape, three with vertical hatch, and four with solid triangle design elements were recovered from the cave—31 sherds in all.

(2) Smudged Decorated (Martin, Rinaldo and Antevs, 1949, p. 188; Martin and Rinaldo, 1950b, pp. 507, 524). Vessel shapes: Bowls only. Design elements (Fig. 21): Parallel lines, chevrons, and nested triangles were recovered. Remarks: Twenty-one sherds and one whole bowl (Fig. 17) of this type were recovered from the cave. The design on the bowl consisted of an isolated group of chevrons pendent from the rim. The resemblance to Mimbres Bold Face Black-on-White design is remarkable by contrast with the contemporary Reserve Black-on-White designs.

B. *Plain and Textured Types* (Fig. 18). Three plain types having their beginnings in earlier phases were recovered:

(1) Alma Plain. The majority of Alma Plain sherds from these levels were body sherds and probably came from the bodies of neck corrugated vessels.

(2) San Francisco Red.

(3) Reserve Smudged.

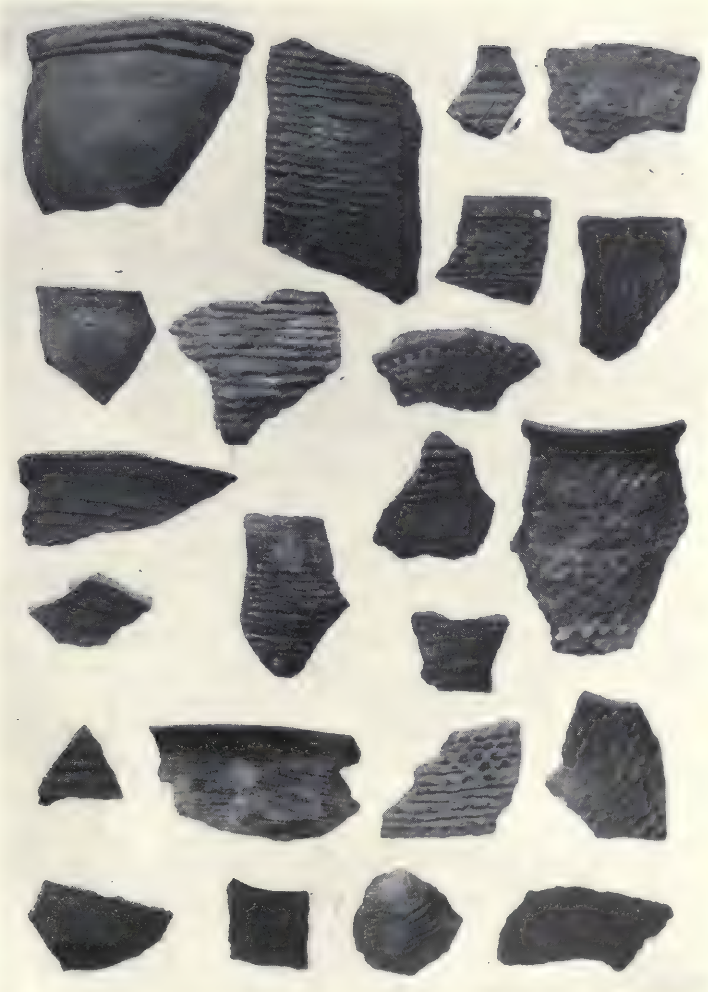


FIG. 18. Pottery sherds, textured wares: Reserve Fillet Rim, Tularosa Fillet Rim, Alma Neck Banded, Alma Scored, Plain Corrugated, Incised Corrugated, Tularosa Patterned Corrugated, Plain and Indented Corrugated, and Reserve Indented Corrugated.

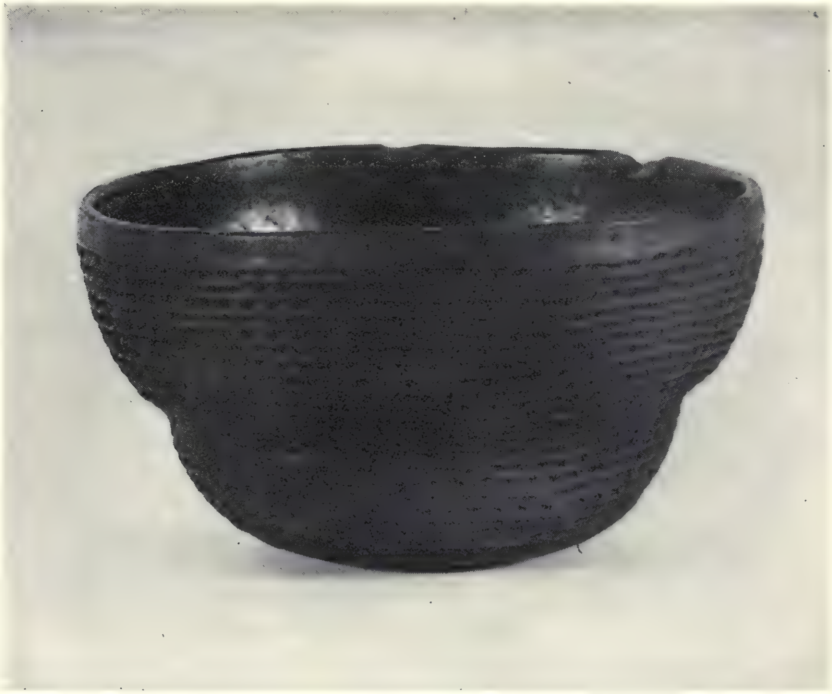


FIG. 19. Indented Corrugated double flare bowl with smudged interior, from Square 6R1, Level 2, Tularosa Cave. Diameter, 15.9 cm.

Notes on these types and references to descriptions of them will be found under the headings "Georgetown Phase" and "San Francisco Phase." In addition to these plain types, four textured types were recovered:

(4) Plain Corrugated includes all-over corrugated such as Mimbres Corrugated (Bradfield, 1931, p. 41) and neck corrugated such as Mimbres Neck Corrugated (Cosgrove, 1932, p. 83). Vessel shapes: Wide-mouthed jars. Remarks: 286 sherds of Plain Corrugated were recovered from the cave. Nine additional sherds of a variant having polished smudged interiors were recovered from the cave.

(5) Reserve Indented Corrugated (Fig. 19; Gladwin, 1934, p. 18; Martin and Rinaldo, 1950b, pp. 501, 530). Vessel shapes: Wide-mouthed jars, bowls. Remarks: 463 sherds of this type were recovered from the cave.

(6) Reserve Fillet Rim (Martin and Rinaldo, 1950a, p. 360; 1950b, p. 501). Undescribed type. Vessel shapes: Only bowls were

recovered. Remarks: This type differs from Tularosa Fillet Rim in that it has a plain corrugated or banded fillet rather than the indented corrugated fillet of the later type. Only five sherds were recovered.

(7) Incised Corrugated (Martin and Rinaldo, 1950a, pp. 359–360; 1950b, pp. 501, 529). Vessel shapes: Wide-mouthed jars. Remarks: Only nine sherds of this type were recovered from the cave.

POTTERY OF THE TULAROSA PHASE

A. *Painted Wares.* Although two painted types, Tularosa Black-on-White and Reserve Polychrome were recovered during the course of the survey (Martin, Rinaldo and Antevs, 1949, p. 24), only the former type was recovered from Tularosa Phase levels in the cave. It is possible that St. John's Polychrome and Wingate Black-on-Red (Fig. 21) also belong to the pottery complex for this phase.

(1) Tularosa Black-on-White (Gladwin, 1931, pp. 32–35; Hawley, 1936, pp. 46–47; Kidder, 1924, p. 98; Nesbitt, 1938, p. 139). Vessel shapes: Pitchers, bowls, ladles. Design elements (Fig. 20): Twelve with terraced solids, eleven with vertical hatch, ten with medium line meander, nine with solid and hatched scroll, five with diagonal hatch, five with solid oblique sawteeth, two with cross hatch, three with solid triangle, three with narrow line, one with broad line, two with ticked line, and two with hatched oblique sawteeth design elements were recovered—65 sherds in all.

B. Plain and Textured Wares. The plain and textured types recovered from levels of this phase such as Alma Plain, San Francisco Red, Reserve Smudged, Reserve Indented Corrugated, and Plain Corrugated have been noted above for earlier phases. In addition, there were recovered two textured types characteristic of the Tularosa Phase—Tularosa Fillet Rim and Tularosa Corrugated Patterned.

(6) Tularosa Fillet Rim (Kidder, 1924, p. 98; Gladwin, 1934, p. 18). Vessel shapes: Bowls only. Remarks: The bodies of these bowls are identical to Reserve Smudged; the rims are decorated with an indented corrugated fillet two or three coils in width. Occasionally the rim flares slightly. The exterior is a plain polished brown like Alma Plain and the interior a polished smudged black like Reserve Smudged. Fifty-seven sherds of this type were recovered from the cave.

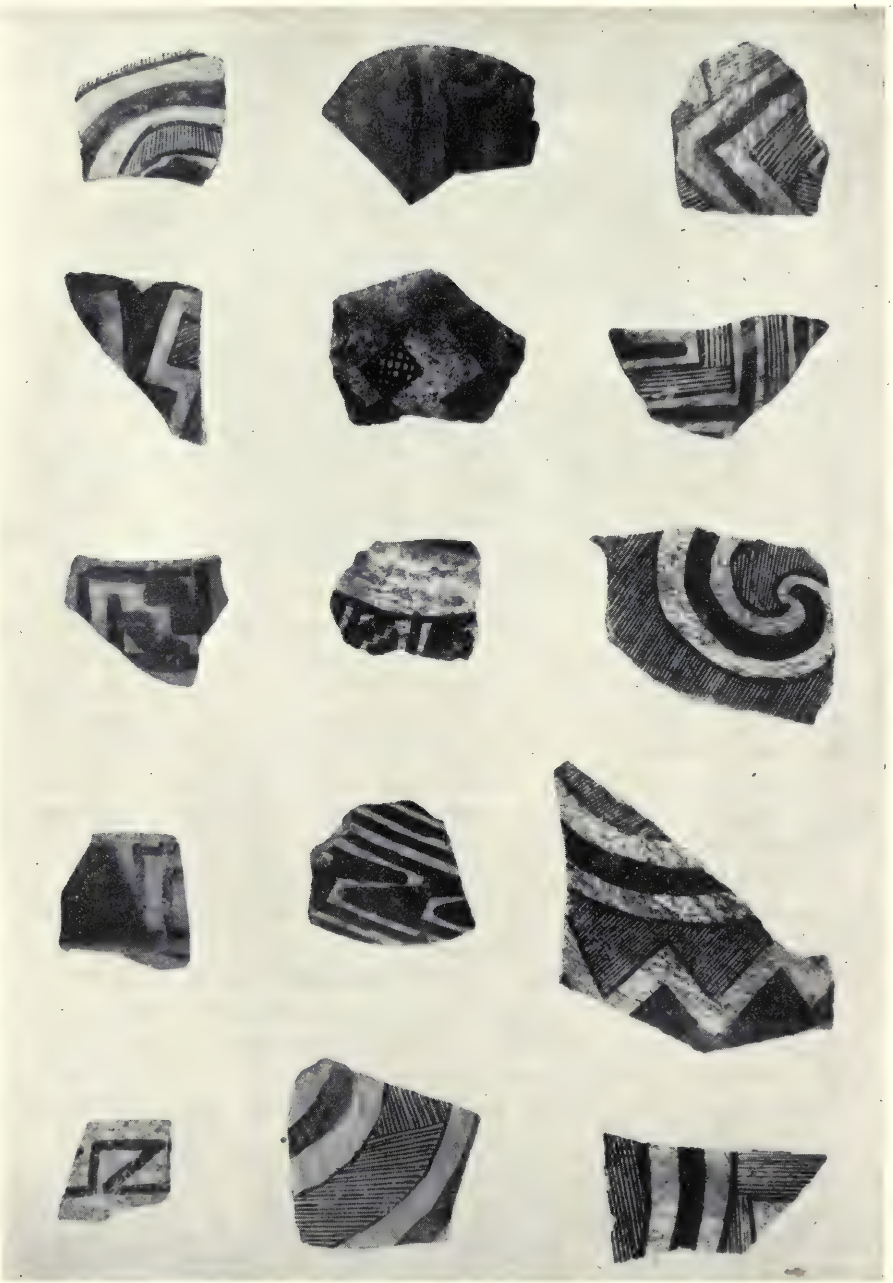
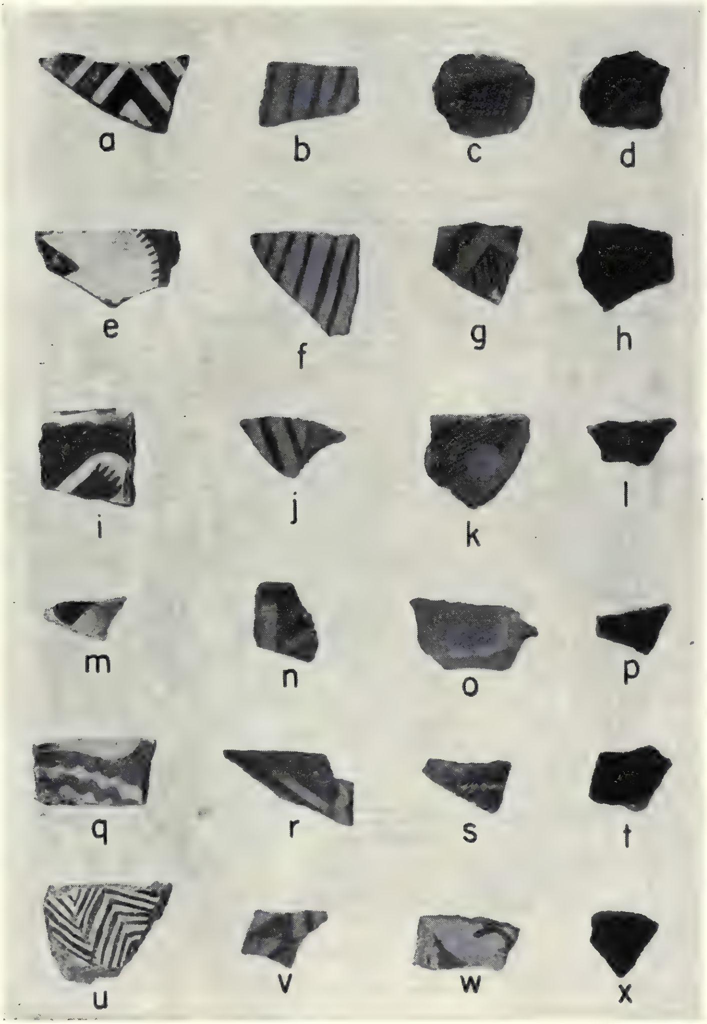


FIG. 20. Tularosa Black-on-White potsherds.

(7) Plain and Indented Corrugated includes plain corrugated jar sherds decorated with indented corrugated patterns (Martin and Rinaldo, 1950b, pp. 501, 529), and bowl sherds of Tularosa Corrugated Patterned (Kidder, 1924, p. 98; Gladwin, 1934, p. 18). Vessel shapes: Wide-mouthed jars, hemispherical bowls. Design: Alternating bands of plain and indented corrugations. Remarks: The bowls have a polished smudged black interior. Although other designs in the indented corrugations occur, they were not recovered from the cave. Fifty-eight sherds of this type were recovered.

Trade Wares

Sherds of several other types besides those listed above were found in varying quantities in the upper levels of the cave. Some of these are La Plata Black-on-White, White Mound Black-on-White, Kiatuthlanna Black-on-White, Puerco Black-on-White, St. Johns Polychrome (Figs. 21, 22). These types represent such a small proportion of the sherds excavated that they are thought to be trade wares. By giving us relative typological dating, to a certain extent they serve as a check on the phase classification of the squares and levels. For example, it was found that La Plata Black-on-White sherds had their greatest frequency in the more pure San Francisco Phase levels, and White Mound Black-on-White and Kiatuthlanna Black-on-White (both later types in the area to the north) a greater frequency in the levels above. Puerco Black-on-White was found only in the uppermost levels. Lino Gray was recovered from Georgetown Phase levels and all later levels, but had its greatest frequency in the mixed San Francisco-Tularosa Phase levels. It was one of the two most numerous of the trade types; eighteen sherds were recovered. La Plata Black-on-White was the most numerous of the painted trade pottery types. Twenty-one sherds of this type were found. It has been considered to be diagnostic of Basketmaker III (Morris, 1927, pp. 170–177; 1939, pp. 151–156; Roberts, 1929a, pp. 107–124; Hawley, 1936, p. 23). The next most numerous painted trade type is White Mound Black-on-White, of which La Plata Black-on-White is the antecedent. White Mound Black-on-White is known best from the type site, White Mound Village, which has been dated from A.D. 750 to 800 by Gladwin (1945, p. 37). Thus it would seem that the earlier part of the San Francisco Phase occupation of the cave would date before A.D. 750 and that the latter part of that occupation would date in the last half of the eighth century and the first half of the ninth.


a
b
c
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g
h
i
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k
l
m
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o
p
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u
v
w
x

FIG. 21. Pottery sherds, minority and intrusive types: Mimbres Classic Black-on-White (*a, e, i, m*), Mimbres Bold Face Black-on-White (*q, u*), Three Circle Red-on-White (*b, f, j, n, r, v*), Wingate Black-on-Red (*c, g, k*), St. Johns Polychrome (*o, s*), and Smudged Decorated (*d, h, l, p, t, x*); Hohokam (?; *w*).

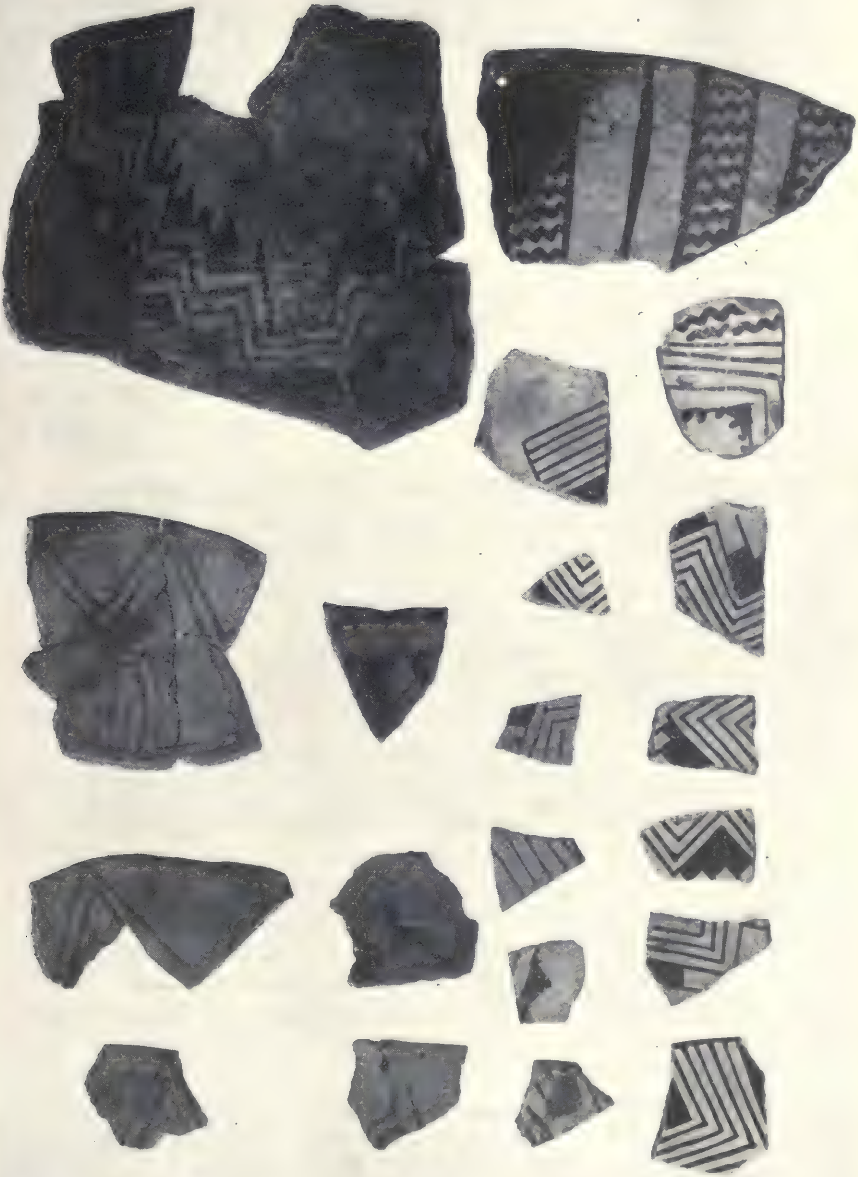

FIG. 22. Pottery sherds: La Plata Black-on-White (left), White Mound Black-on-White (lower right), and Kiatuthlanna Black-on-White (upper right).

Unfired Pottery with Vegetal Temper

Forty-two sherds of vegetal-tempered unfired pottery (Fig. 23) were recovered from the cave. Only one of these came from preceramic levels. The remainder were all associated with true pottery. They occurred with greatest frequency in levels of the San Francisco Phase, and were found in all pottery-bearing levels of the cave down to Level 7.

They range in color from pinkish tan to a dark gray or black. The color of the dark gray sherds appears to be the result of use, during which they acquired a coating of dirt and grease, or the result of accidental firing. In the latter case the interior of the sherd is porous where the vegetal-tempering material has burned out. Normally the concave interior surface of the sherds shows smoothing but no polishing. Those coated with dirt and grease are smoother than the others.

The majority of these unfired sherds bear coiled basketry impressions on their convex exterior surface. The rim surfaces are plain. They range in thickness from 6 mm. to 1.3 cm. Usually the free standing rim is 2 mm. or 3 mm. thicker than the basketry-impressed wall. The lip surface is rounded. Two of the rim sherds bear lines which show that they were built up of successive layers of fillets or coils about 1 cm. thick.

One sherd bears the impression of twill-plaited basketry. Two others are plain. One sherd is tempered with chaff. The remainder are tempered with finely shredded cedar bark.

Only bowl shapes are indicated. In all except color they bear a close resemblance to the unfired pottery illustrated by Morris (1927) from Canyon del Muerto. Another unfired vegetal-tempered sherd from Tularosa Cave is illustrated by Hough (1914, Pl. 6). Other examples of similar basket-molded unfired pottery have been reported from northeastern Arizona (Guernsey and Kidder, 1921, p. 98; Guernsey, 1931, pp. 84–85; Morris, 1939, p. 157, footnote) and Utah (Nusbaum, Kidder and Guernsey, 1922, pp. 142–143). They occur in Basketmaker II sites without true pottery (see above) and in association with true pottery in Basketmaker III sites (Morris, 1939, p. 157). Morris (loc. cit.) has even reported them from a Pueblo I site in the La Plata district. A sherd, apparently of this type, is illustrated by Roberts (1929a, Pl. 12), from Shabik'eshchee. Basketry-molded sherds from two bowls of the same shape with free standing rim, but of Alma Plain paste were recovered from Pithouses E and U at the SU Site (Martin, 1940, p. 84). Sayles illustrated (1945, Pl. LV) a like sherd. The fact that Morris found more than thirty complete unfired vessels in Basketmaker III sites, coupled with the increase in frequency of unfired sherds from the lowest levels to the higher levels in Tularosa Cave seems to suggest that the practice of lining baskets with clay was not related directly to the manufacture of true pottery.

However, Morris (1939, pp. 145, 153) also describes and illustrates pottery vessels that appear to be transitional between the unfired vessels and the true developed pottery. One is a light gray sand-tempered bowl of the same form as the basket-molded specimens (this was recovered from a Basketmaker III horizon), and the other is a squash pot made from vegetal-tempered clay and molded in "some sort of fabric container." The analogy of these vessels to the basket-molded fired sherds of Alma Plain from the SU Site seems obvious.

Thus in the San Juan and in the Upper Gila drainages we appear to have parallel situations. In a time when gourds and baskets were the containers most widely used, we have evidence that bowl baskets were lined with clay mixed with finely shredded cedar bark. Furthermore, after the people in both areas started to make true pottery they continued the earlier practice of lining bowl-shaped baskets with vegetal-tempered clay. Then this practice became more popular, as is shown by an increase in the frequency of fiber-tempered, unfired sherds and vessels even in the periods after true pottery began to be made. Also at the same time there were made some transitional forms between the true pottery and the unfired pottery.

Among the several possibilities that occur are two alternatives which seem best to fit this situation according to the small amount of evidence that we have at our disposal:

(1) That the method of manufacturing true pottery developed from the manufacture of this unfired fiber-tempered pottery through stages for which we have only a small amount of evidence in rare specimens.

(2) That the method of manufacturing true pottery was introduced from elsewhere fairly well developed, and that the custom of lining baskets with fiber-tempered clay is a traditionally separate but technically related concept with an independent increase and decline in popularity. In this case the transitional specimens would represent evidence that the early people recognized a technical parallel between their previous custom and the introduced concept

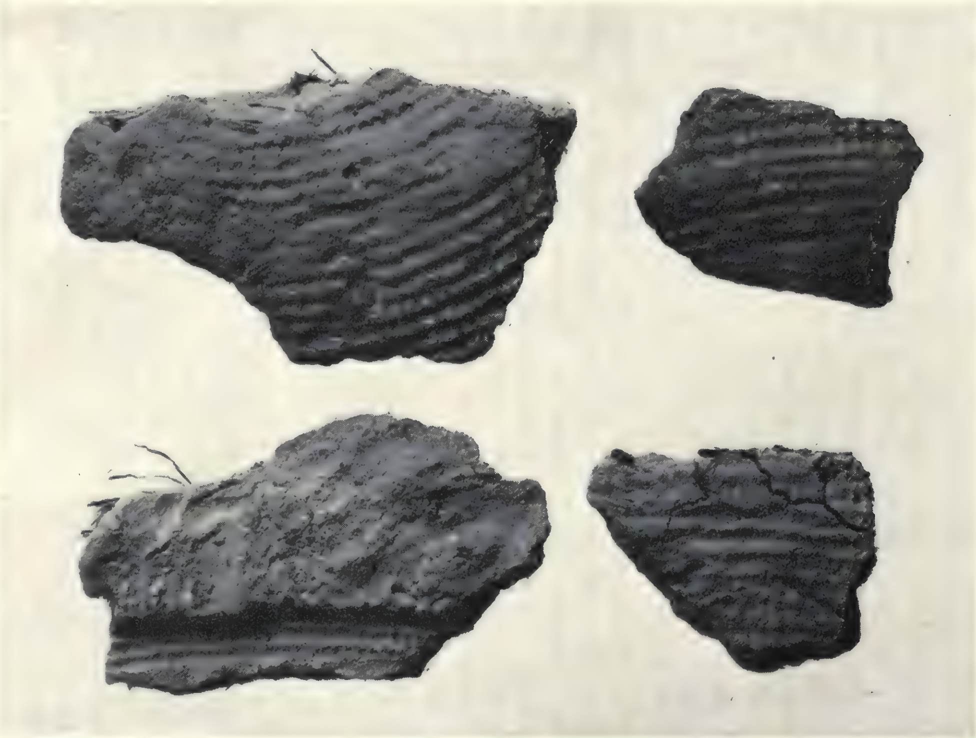

FIG. 23. Sherds of unfired basketry-impressed pottery.

of true pottery. We might further conjecture that the new method of making containers was accepted because it was compatible with their culture in that it already included a parallel custom.

Although these ideas have been suggested before, at the moment the evidence is not convincing for either of these alternatives. In favor of local origin and parallel development there are a series of roughly analogous developments in the eastern United States (Griffin, 1946, pp. 43–47), where fiber-tempered basket-marked bowls of similar shape precede more highly developed grit-tempered types. Furthermore, there is also some evidence for a limited series of steps in this development in the Southwest (the transitional specimens).

As evidence in favor of a foreign source, from which the method for making true pottery was introduced into the Southwest, there is the fact that, as we know the Southwestern pottery types at present, a number of the earliest, such as San Francisco Red from the SU Site and the Cave Creek Site, Fine Paste Brown from the Bluff Site, and the fine unnamed yellow-gray ware from Broken Flute Cave, are technically fine types that represent a considerable step in development in the pottery-making craft beyond unfired pottery.

Pottery Occurrence by Cave Area

After each level in every square had been classified as to phase according to the pottery types, they were mapped out according to horizontal and vertical section (Fig. 24) and the following conclusions were reached:

During the first three periods of occupation (Pre-Pottery, Pine Lawn Phase and Georgetown Phase), the trash resultant from the occupation was divided into two areas—the front and back of the cave towards the east side. The middle and the west third remained unoccupied (at least these were without non-pottery or plain ware trash levels). The deepest accumulation of trash during these periods was toward the mouth of the cave and toward the east wall. Here there was the deepest trash accumulation (7–11 feet) in the cave.

The entire cave was occupied during the San Francisco Phase. Pottery types characteristic of this phase were recovered from all areas of the cave in levels above the plain ware levels. In most sections of the cave the thickness of this San Francisco Phase trash is as deep as the depth of trash accumulated during all the preceding

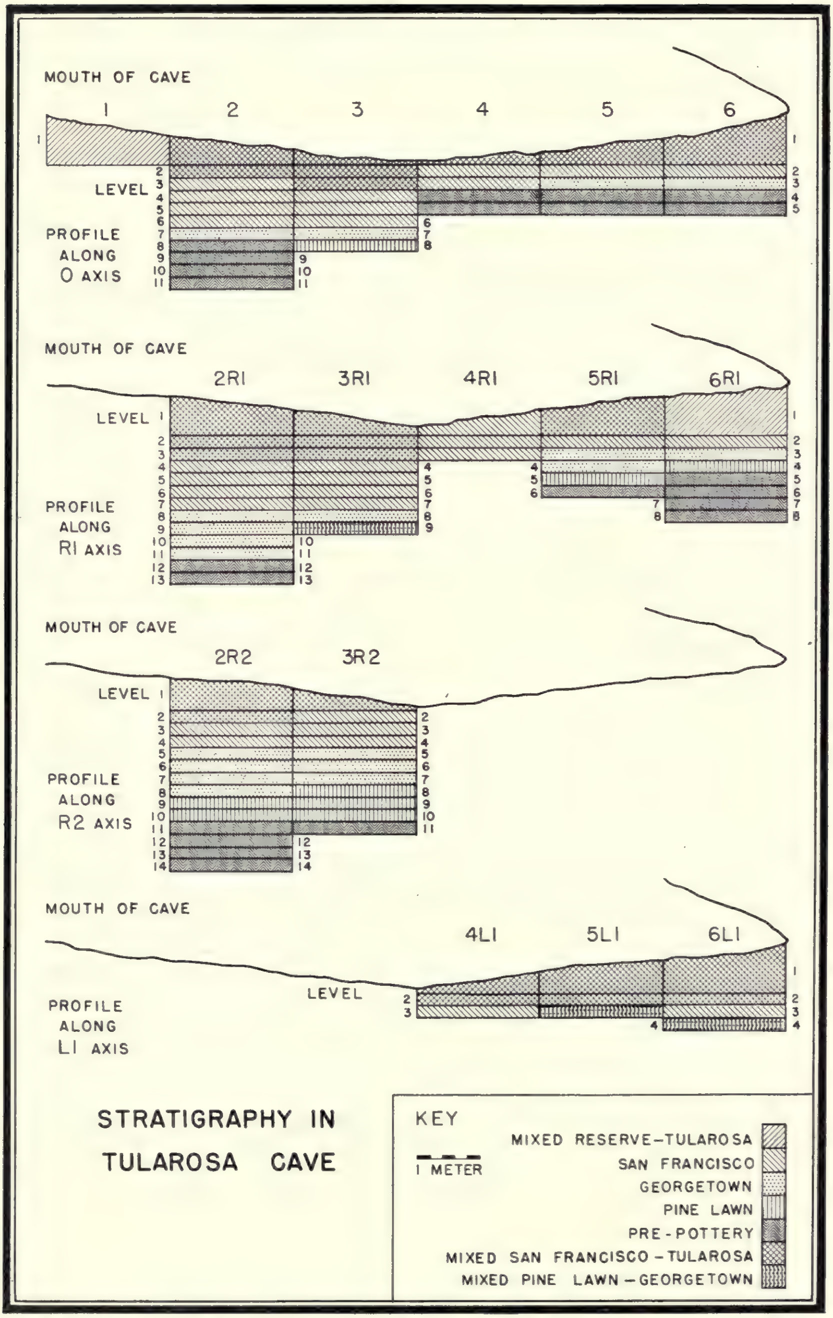
MOUTH OF CAVE
1 2 3 4 5 6
LEVEL
PROFILE ALONG O AXIS
MOUTH OF CAVE
2R1 3R1 4R1 5R1 6R1
LEVEL
PROFILE ALONG R1 AXIS
MOUTH OF CAVE
2R2 3R2
LEVEL
PROFILE ALONG R2 AXIS
MOUTH OF CAVE
4L1 5L1 6L1
LEVEL
PROFILE ALONG L1 AXIS
STRATIGRAPHY IN TULAROSA CAVE
KEY
1 METER
MIXED RESERVE–TULAROSA
SAN FRANCISCO
GEORGETOWN
PINE LAWN
PRE-POTTERY
MIXED SAN FRANCISCO–TULAROSA
MIXED PINE LAWN–GEORGETOWN

FIG. 24. Stratigraphy in Tularosa Cave.

period and moreover covers a wider area. In other words the total accumulation of San Francisco Phase trash is probably greater than that of the preceding three periods. However, this is not certain, because in the uppermost levels there is considerable admixture with trash from the Reserve and Tularosa phases and it is difficult to separate the earlier from the later. This great accumulation of trash during the San Francisco Phase might indicate a long occupation, occupation by a larger number of people, or simply a culture that favored the increased accumulation of waste products.

In the uppermost levels the pottery types most prevalent during the San Francisco, Reserve and Tularosa phases are mixed in almost every section, but there is considerable variation in the proportions and the degree to which they are mixed. In the top levels at the mouth of the cave where the pueblo rooms were located and at the back of the cave where considerable ceremonial paraphernalia was recovered the proportion of early pottery types was particularly low.

To a certain extent the differences in the phase allocation of the same levels of adjoining sections may be due to the slope of the bedrock floor of the cave. Although the hollows and pits were filled in, the surface of the trash in any period probably followed the general contour and slope of the floor.

Cordova Cave

By PAUL S. MARTIN

Pottery sherds from Cordova Cave were few. A total of twenty-two squares, which were broken down into 139 levels, yielded only 739 sherds and seven whole or restorable vessels.

The pottery types from this cave do not represent a complete series of Mogollon pottery types. Indeed, only ten types were found, plus two Anasazi types. In Tularosa Cave, a total of fifteen Mogollon types was found plus five Anasazi types. Mogollon Red-on-Brown, Three Circle Red-on-White, and Reserve Black-on-White sherds were not encountered. This is a curious situation.

Therefore the paucity of numbers as well as types was a handicap.

The method of excavation and analysis, the techniques of pottery reconstruction, and the shapes of the pottery were the same as those for Tularosa Cave, described in detail in this chapter, and therefore they are not repeated here. Mogollon Brown Ware series constituted

98.5 per cent of all the pottery found in Cordova Cave, while the remainder, 1.5 per cent, was Anasazi Black-on-White (trade pieces).

When work was first started in Cordova Cave, the refuse extended evenly from wall to wall. After digging had proceeded for a few weeks, we found that the cave floor was divided by a narrow, deep crevice (from 1.5 to 3 meters wide and from 1 to 3 meters deep) that extended from front to rear. This crevice was completely chocked with refuse and was not at all apparent when we first examined the cave.

The crevice was probably occupied or at least used for refuse; but because of this break in the floor, the available floor area was limited.

Occurrence by Levels and Phases

As in Tularosa Cave, no pottery was recovered from the lowest levels of Cordova Cave. Seventy-one levels of the 139 excavated yielded no pottery or merely one or two Plain Ware sherds. These were classified as Pre-Pottery levels.

We had hoped to manipulate the pottery data in a statistical manner and then to seriate the percentages. Unfortunately, the total number of sherds was too small. The greatest number of sherds from any square-level was thirty; most square-levels yielded only fifteen or twenty and frequently less.

A seriation was made, but it merely demonstrated that late types were in the top levels and that Alma Plain was present in all levels, from early times to late.

Then a seriation was made of pottery types by lumping all levels horizontally from the front to the rear of the cave; that is, the different pottery types from Level 1, front to rear, from all squares were treated statistically; all those from Level 2, from front to rear, were lumped together, and so on. The seriation arrived at in this manner told us nothing that we did not already know and did not aid us at all in assigning any level or levels to a particular phase.

Fortunately, there were distinct "natural" levels or beds composed of (from bottom to top) (1) tan sand; (2) brown dust and fiber; (3) dark gray dust, ash, and charcoal; (4) light gray ash; and (5) (top layer) gravel, fiber, and dung.

A careful record of these natural levels had been kept. They were plotted (Fig. 25) and superposed on the grid of arbitrary squares and levels we had set up (Fig. 26). We thereby achieved

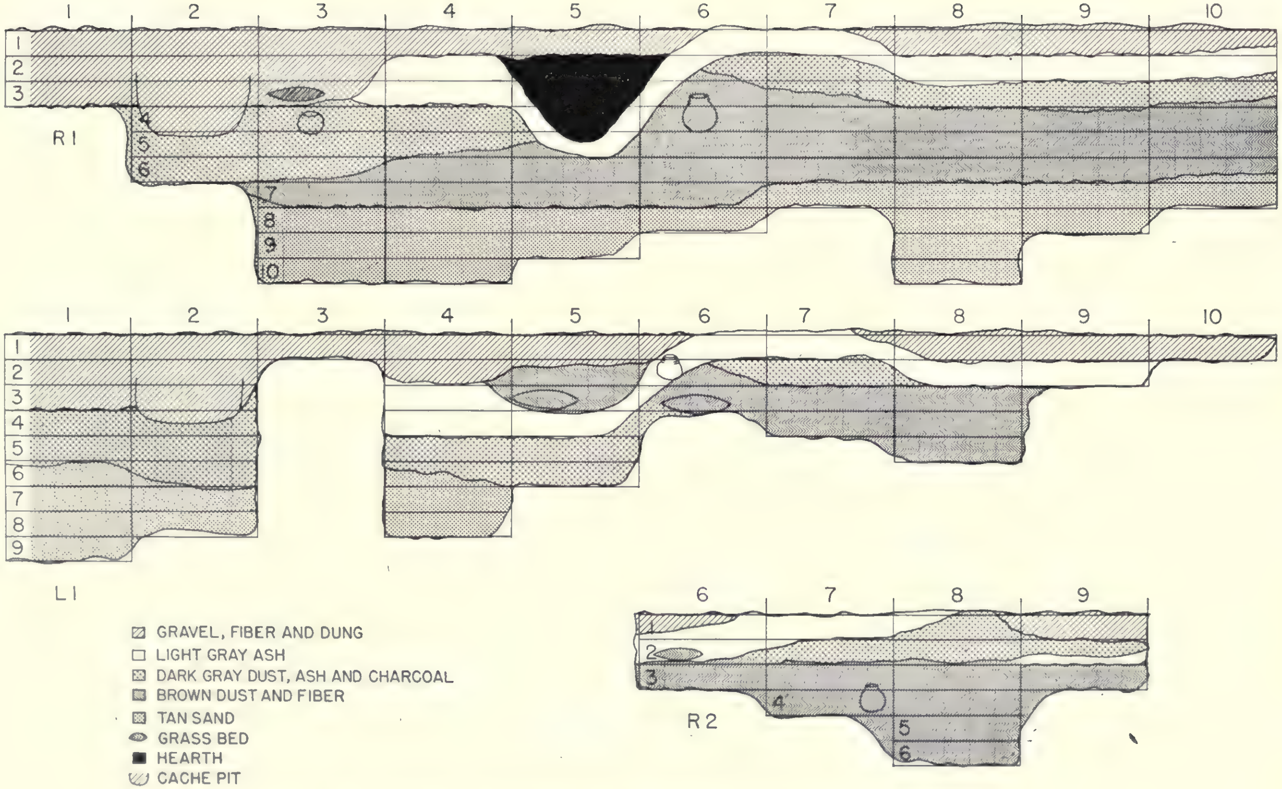
1 2 3 4 5 6 7 8 9 10
R1
1 2 3 4 5 6 7 8 9 10
L1
6 7 8 9
R2
GRAVEL, FIBER AND DUNG
LIGHT GRAY ASH
DARK GRAY DUST, ASH AND CHARCOAL
BROWN DUST AND FIBER
TAN SAND
GRASS BED
HEARTH
CACHE PIT

Fig. 25. Schematic diagram showing natural stratigraphy, Cordova Cave.

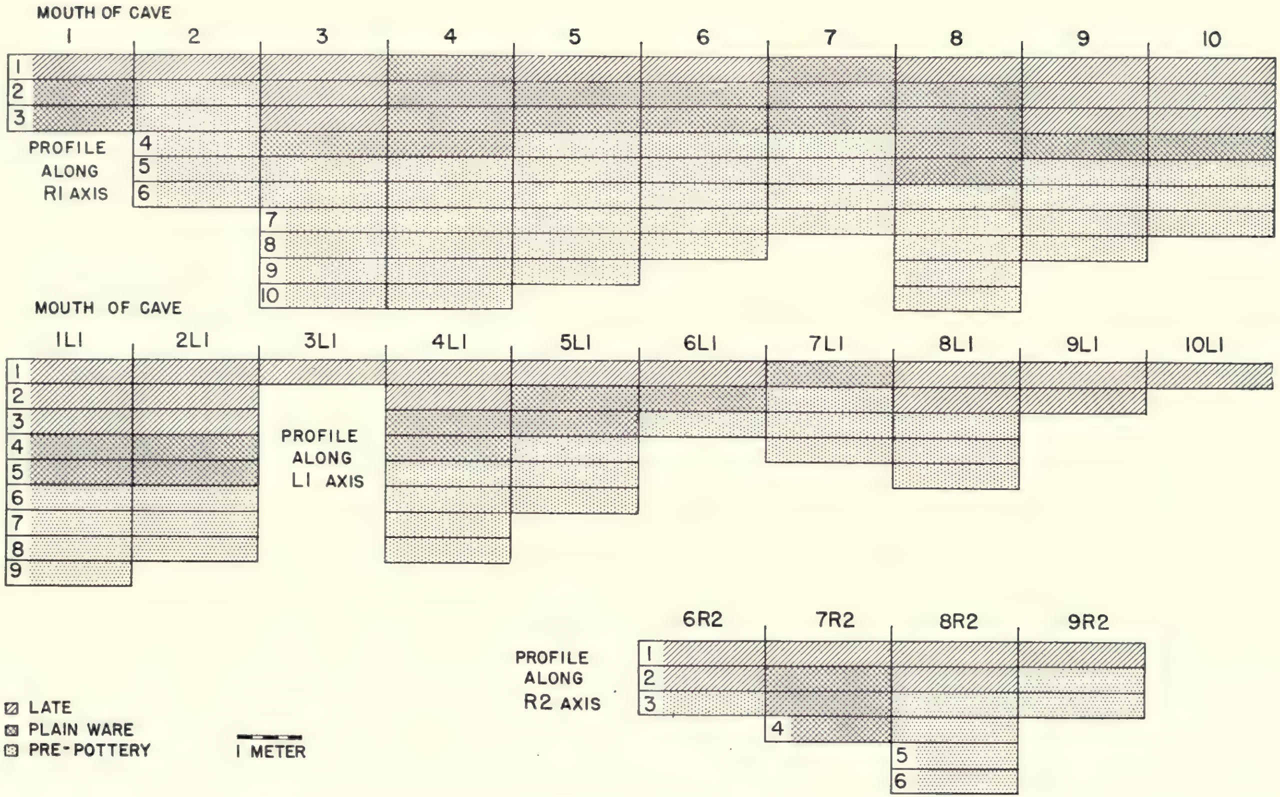
MOUTH OF CAVE
1
2
3
4
5
6
7
8
9
10
PROFILE ALONG R1 AXIS
1
2
3
4
5
6
7
8
9
10
MOUTH OF CAVE
1L1
2L1
3L1
4L1
5L1
6L1
7L1
8L1
9L1
10L1
PROFILE ALONG L1 AXIS
1
2
3
4
5
6
7
8
9
6R2
7R2
8R2
9R2
PROFILE ALONG R2 AXIS
1
2
3
4
5
6
▨ LATE
▩ PLAIN WARE
▦ PRE-POTTERY
1 METER

FIG. 26. Stratigraphy in Cordova Cave. Vertical scale twice horizontal scale.

a clearer idea of the stratigraphy and were able to assign the strata to three time horizons. These are, from bottom to top: (*a*) Pre-Pottery (about 500 B.C.–A.D. 1); (*b*) a Plain Ware horizon (about A.D. 1–A.D. 700); and (*c*) a Late Horizon (about A.D. 700–A.D. 1100). Finer, chronological subdivisions were not possible because of the paucity of sherds and because of the absence of certain pottery types that are considered as sensitive indicators of time (Alma Scored, Alma Incised, San Lorenzo Red-on-Brown, Mogollon Red-on-Brown).

It seems clear that Cordova Cave was occupied before the beginning of the Christian Era. Dampness in the tan sand, Pre-Pottery levels, had destroyed the items of perishable nature; but tools of bone and of stone, the latter exhibiting the familiar Cochise characteristics, were recovered.

Some time between A.D. 1 and A.D. 500 a fire occurred in the cave, spreading, perhaps, from a hearth (Square 5R1), and burning the inflammable materials (beds of grass and fibers, matting, basketry, sandals, and cordage) from front to back. The fire may have smoldered for some time like a fire in a peat bog, slowly working downward. This catastrophe accounts for the light gray ash and dark gray-dust ash, and charcoal layers in the cave; and also accounts for the destruction of the materials we desired.

After the fire, the cave was occupied but little, perhaps only by small parties of hunters.

The refuse from the three different time horizons was distributed more or less evenly throughout the cave from front to back.

Pottery Types

The pottery of the Plain Ware horizon consisted of Alma Plain, Alma Rough, and San Francisco Red. References to descriptions and shapes are given on page 56.

The pottery of the Late Horizon consisted of Alma Plain, San Francisco Red, Reserve Smudged, Plain Corrugated, Three Circle Neck Banded, Reserve Indented Corrugated, Tularosa Fillet Rim, Mimbres Bold Face Black-on-White, and Mimbres Classic Black-on-White. (For descriptions and references see pp. 56–67).

The counts for each square and level are given in Table 2.

In classifying the pottery, the question arose as to the differences between Alma Neck Banded and Three Circle Neck Corrugated types. The question could probably be easily settled if one had whole vessels to check; but in the case of sherds, and especially in the case of small sherds, the differences are not too easily seen. In the original descriptions given by Haury (1936b, pp. 35, 36), neck banded ware is characterized as having flat coils, with slight overlap, rarely indented, with polishing over the coils so that they were largely obliterated, giving the neck section of the vessel a fluted appearance.

On the neck banded pots from the Reserve area, the coils may be smoothed and polished but very frequently are not. We have been able to perceive this type most easily by the width and flatness of the coils. In general, they are wider and flatter than those on the neck corrugated ware.

The Three Circle Neck Corrugated ware has, as Haury stated, coils that are narrower, laid obliquely in clapboard style, and rarely indented. A checking on the coils in drying gives the appearance of indenting, but close examination makes it easy to distinguish between checking and deliberate indentations. If one is lucky enough to have a sherd that shows the lowest coil or the one that adjoins the body of the vessel, one will find that it frequently, but not always, is tooled, indented, or textured in some manner.

Whole or Restorable Pottery

One complete and three partially complete (and restorable) plain ware pots were found.

(1) Three Circle Neck Corrugated jar (complete) in Square 6L1, Level 2 (cat. no. 261852; Fig. 27).

(2) Alma Plain jar in Square 3L1, Level 4. This jar was filled with seeds of *Mentzelia multiflora* and was stoppered with a plug of grass and pine needles (cat. no. 261851).

(3) San Francisco Red, Saliz Variety, jar in Square 6R1, Levels 3, 4, 5, and 6 (cat. no. 262027).

(4) Alma Plain jar in Square 6R1, Levels 3, 4, and 5 (cat. no. 262026).

Unfired Pottery with Vegetal Temper

Fibre-tempered sherds turned up in Cordova Cave as in Tularosa Cave (pp. 70–73). Nine were recovered from both the Plain Ware and Late horizons: two in Square 6R2, Level 1; three in Square 6R2, Level 2; one in Square 7R1, Level 1; one in Square 8R1, Level 4; one in Square 8L1, Level 2; one in Square 9R1, Level 3. Several

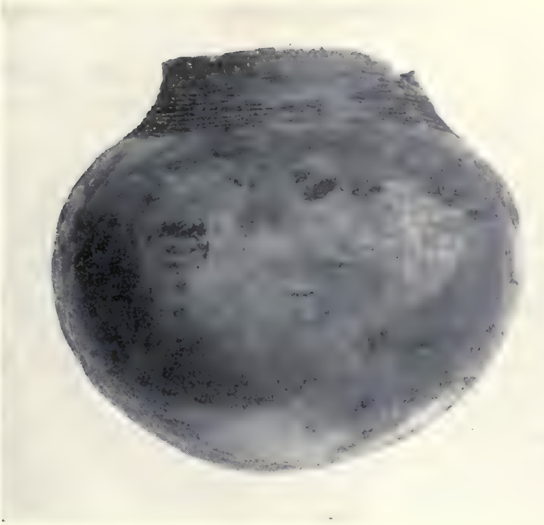

FIG. 27. Three Circle Neck Corrugated jar, Cordova Cave. Height, 30 cm.

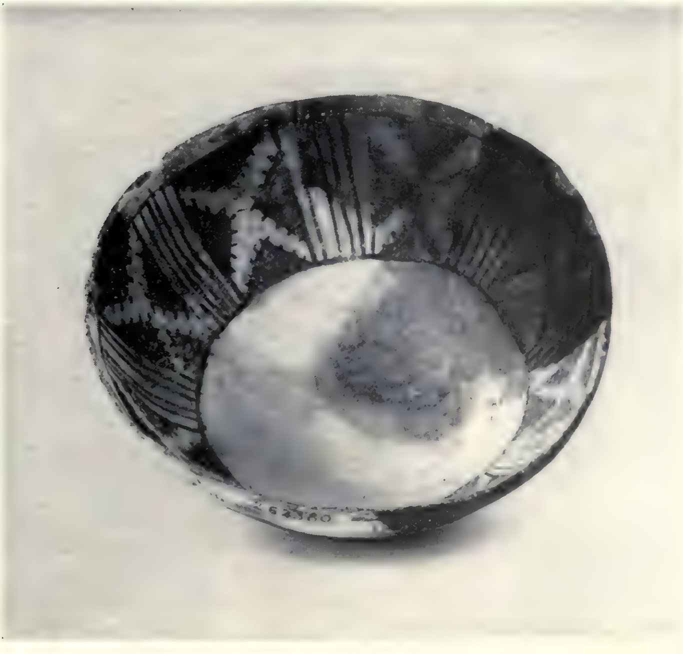

FIG. 28. Puerco Black-on-White bowl, Cordova Cave. Diameter, 22.3 cm.

bear impressions of basketry, in which, we believe, this type of pottery was modeled, and a lip or ridge that may mark the edge of the basket-mold.

In some circumstances, this type of pottery might precede true or fired pottery. We think this is probably not true for the Mogollon area, since both true as well as unfired pottery occur together except for one or two unfired sherds that occur in Pre-Pottery levels in Tularosa Cave. This latter association is probably an accidental one.

Trade Wares

Three incomplete but restorable black-on-white bowls were recovered.

(1) Mimbres Bold Face Black-on-White(?) bowl from Square 6L1, Level 1, and Square 8R1, Levels 1 and 2 (cat. no. 263379; Fig. 30).

(2) Black-on-White bowl from Squares 6R2, 8R1, and 9R1, Level 1 (cat. no. 263378; Fig. 29). A photograph of the sherds of the bowl was sent to Mr. Stanley Stubbs of the Museum of New Mexico, Santa Fe, but he was unable to make an exact identification of the type. On the basis of the photograph he said (by letter) ". . . [this bowl] has some of the features of Mimbres pottery, the filling-in of a corner of the hatched triangles with black; the lay-out looks more like a Chaco P(ueblo) II." He *guessed* that it might be a Mimbres type.

(3) Puerco Black-on-White bowl or a peripheral variant of Chaco Black-on-White pottery that would date in the tenth century (cat. no. 263380; Fig. 28).

These trade pieces represent the "Late" occupation of the cave and make it possible to assign dates from A.D. 900 to A.D. 1000 to the upper layers.

The pottery from Cordova Cave shed no new light on the origin, development, and growth of Mogollon culture. The stratification corroborated the pottery sequence that was discovered at Tularosa Cave and permitted us to assign rough chronological limits to the various levels.

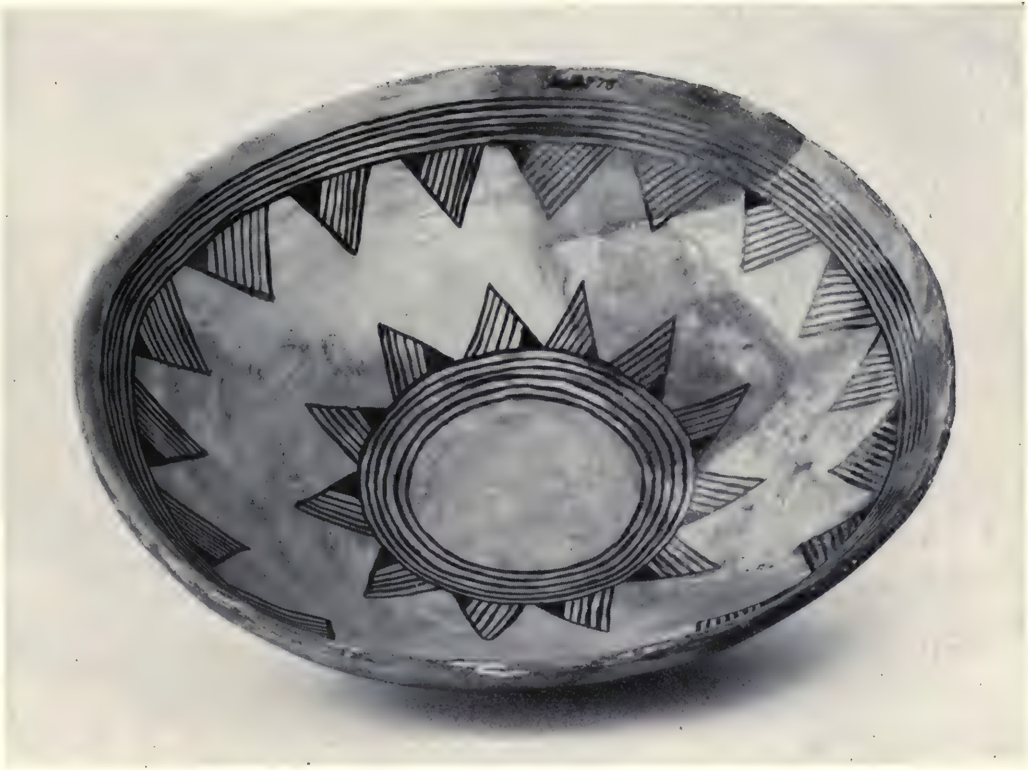

FIG. 29. Black-on-White bowl, Mimbres type(?), Cordova Cave. Diameter, 32.7 cm.

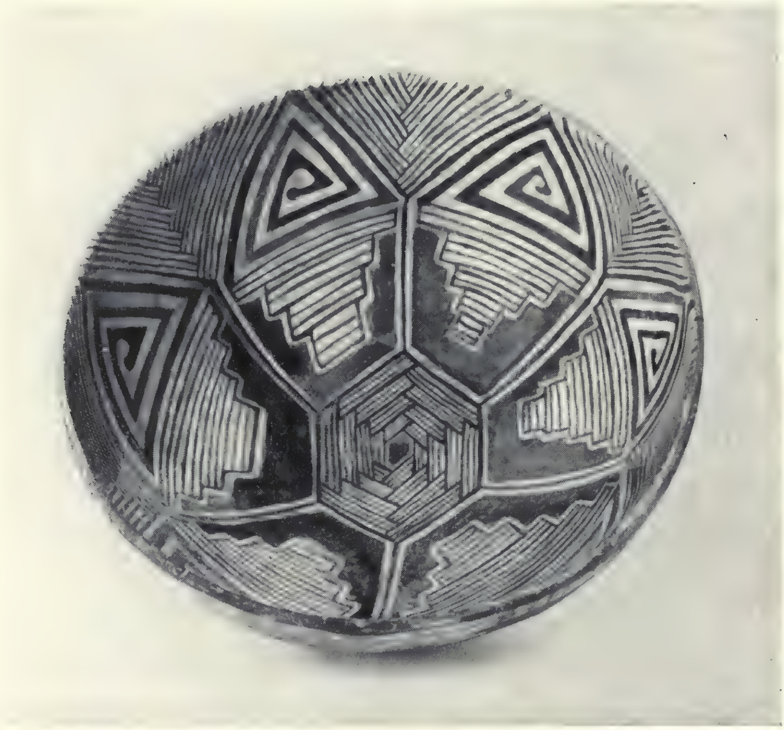

FIG. 30. Mimbres Bold Face Black-on-White(?) bowl, Cordova Cave. Diameter, 24.2 cm.

TABLE 1.—SHERD ANALYSIS, TULAROSA CAVE

SQUARE 2*

	Level 1		Level 2		Level 3		Level 4	
	No.	%	No.	%	No.	%	No.	%
Alma Plain	80	43.71	59	53.15	36	53.73	55	70.51
Alma Rough	..	.....	..	.....	3	4.48	..	.....
San Francisco Red	19	10.38	11	9.91	10	14.93	12	15.38
Reserve Smudged	24	13.11	10	9.01	5	7.46	..	.....
Alma Neck Banded	..	.....	1	0.90	1	1.49	1	1.28
Plain Corrugated	6	3.28	11	9.91	2	2.99	3	3.85
Reserve Indented Corrugated	20	10.93	7	6.31	3	4.48	3	3.85
Plain and Indented Corrugated	9	4.92	2	1.80	..	.....	..	.....
Plain Corrugated Smudged	1	0.55	..	.....	..	.....	..	.....
Tularosa Fillet Rim	5	2.73	..	.....	1	1.49	..	.....
Alma Incised	..	.....	..	.....	..	.....	..	.....
Alma Scored	2	1.09	..	.....	..	.....	1	1.28
Lino Gray	..	.....	..	.....	..	.....	..	.....
La Plata Black-on-Gray	2	1.09	..	.....	1	1.49	..	.....
Mogollon Red-on-Brown	10	5.46	3	2.70	4	5.97	..	.....
Mimbres Bold Face Black-on-White	1	0.55	..	.....	..	.....	..	.....
Reserve Black-on-White	..	.....	..	.....	..	.....	1	1.28
Tularosa Black-on-White	3	1.64	3	2.70	..	.....	1	1.28
Puerco Black-on-Red	1	0.55	..	.....	..	.....	..	.....
Indeterminate Black-on-White	..	.....	3	2.70	..	.....	..	.....
Fiber Tempered	..	.....	1	0.90	1	1.49	1	1.28
Total	183	99.99	111	99.99	67	100.00	78	99.99

* Eleven levels dug; four contained no pottery.

TABLE 1.—SHERD ANALYSIS (*continued*)

SQUARE 2 (*concluded*)

	Level 5		Level 6		Level 7		Total	
	No.	%	No.	%	No.	%	No.	%
Alma Plain	94	77.69	29	74.36	55	85.94	408	61.54
Alma Rough	9	7.44	..	.....	..	.....	12	1.81
San Francisco Red	5	4.13	4	10.26	7	10.94	68	10.26
Reserve Smudged	3	2.48	1	2.56	..	.....	43	6.49
Alma Neck Banded	..	.....	..	.....	..	.....	3	0.45
Plain Corrugated	3	2.48	1	2.56	2	3.13	28	4.22
Reserve Indented Corrugated	2	1.65	..	.....	..	.....	35	5.28
Plain and Indented Corrugated	..	.....	..	.....	..	.....	11	1.66
Plain Corrugated Smudged	..	.....	..	.....	..	.....	1	0.15
Tularosa Fillet Rim	1	0.83	..	.....	..	.....	7	1.06
Alma Incised	1	0.83	..	.....	..	.....	1	0.15
Alma Scored	..	.....	2	5.13	..	.....	5	0.75
Lino Gray	1	0.83	..	.....	..	.....	1	0.15
La Plata Black-on-Gray	..	.....	..	.....	..	.....	3	0.45
Mogollon Red-on-Brown	1	0.83	1	2.56	..	.....	19	2.87
Mimbres Bold Face Black-on-White	..	.....	..	.....	..	.....	1	0.15
Reserve Black-on-White	..	.....	..	.....	..	.....	1	0.15
Tularosa Black-on-White	..	.....	..	.....	..	.....	7	1.06
Puerco Black-on-Red	1	0.83	..	.....	..	.....	2	0.30
Indeterminate Black-on-White	..	.....	..	.....	..	.....	3	0.45
Fiber Tempered	..	.....	1	2.56	..	.....	4	0.60
Total	121	100.02	39	99.99	64	100.01	663	100.00

TABLE 1.—SHERD ANALYSIS (*continued*)

SQUARE 2R2*

	Level 1		Level 2		Level 3		Level 4	
	No.	%	No.	%	No.	%	No.	%
Alma Plain	22	48.89	21	58.33	16	42.11	19	52.78
Alma Rough	3	6.67	2	5.56	2	5.26	2	5.56
San Francisco Red	6	13.33	3	8.33	2	5.26	2	5.56
Reserve Smudged	..	.....	1	2.78	..	.....	..	.....
Alma Neck Banded	..	.....	..	.....	..	.....	..	.....
Plain Corrugated	3	6.67	2	5.56	6	15.79	4	11.11
Reserve Indented Corrugated	3	6.67	5	13.89	1	2.63	5	13.89
Plain and Indented Corrugated	..	.....	..	.....	1	2.63	..	.....
Tularosa Fillet Rim	1	2.22	..	.....	..	.....	..	.....
Alma Scored	1	2.22	..	.....	1	2.63	..	.....
La Plata Black-on-Gray	..	.....	..	.....	1	2.63	..	.....
Mogollon Red-on-Brown	3	6.67	1	2.78	5	13.16	2	5.56
Mimbres Bold Face Black-on-White	..	.....	..	.....	..	.....	1	2.78
Reserve Black-on-White	2	4.44	..	.....	1	2.63	..	.....
Tularosa Black-on-White	..	.....	..	.....	1	2.63	..	.....
Puerco Black-on-White	1	2.22	..	.....	..	.....	..	.....
Gray Slipped Interior	..	.....	..	.....	..	.....	..	.....
Fiber Tempered	..	.....	1	2.78	1	2.63	1	2.78
Total	45	100.00	36	100.01	38	99.99	36	100.02

* Fourteen levels dug; three contained no pottery.

TABLE 1.—SHERD ANALYSIS (*continued*)

SQUARE 2R2 (*continued*)

	Level 5		Level 6		Level 7		Level 8	
	No.	%	No.	%	No.	%	No.	%
Alma Plain	12	60.00	11	68.75	5	62.50	38	80.85
Alma Rough	2	10.00	..	.....	..	.....	1	2.13
San Francisco Red	2	10.00	3	18.75	2	25.00	2	4.26
Reserve Smudged	..	.....	..	.....	..	.....	..	.....
Alma Neck Banded	..	.....	..	.....	1	12.50	..	.....
Plain Corrugated	1	5.00	..	.....	..	.....	3	6.38
Reserve Indented Corrugated	1	5.00	1	6.25	..	.....	1	2.13
Plain and Indented Corrugated	..	.....	..	.....	..	.....	..	.....
Tularosa Fillet Rim	..	.....	..	.....	..	.....	..	.....
Alma Scored	..	.....	..	.....	..	.....	..	.....
La Plata Black-on-Gray	..	.....	..	.....	..	.....	..	.....
Mogollon Red-on-Brown	..	.....	..	.....	..	.....	1	2.13
Mimbres Bold Face Black-on-White	..	.....	..	.....	..	.....	..	.....
Reserve Black-on-White	..	.....	..	.....	..	.....	..	.....
Tularosa Black-on-White	2	10.00	..	.....	..	.....	..	.....
Puerco Black-on-White	..	.....	..	.....	..	.....	1	2.13
Gray Slipped Interior	..	.....	1	6.25	..	.....	..	.....
Fiber Tempered	..	.....	..	.....	..	.....	..	.....
Total	20	100.00	16	100.00	8	100.00	47	100.01

TABLE 1.—SHERD ANALYSIS (*continued*)

SQUARE 2R2 (*concluded*)

	Level 9		Level 10		Level 11		Total	
	No.	%	No.	%	No.	%	No.	%
Alma Plain	8	57.14	9	69.23	3	60.00	164	58.99
Alma Rough	1	7.14	..	.....	..	.....	13	4.68
San Francisco Red	5	35.71	4	30.77	2	40.00	33	11.87
Reserve Smudged	..	.....	..	.....	..	.....	1	0.36
Alma Neck Banded	..	.....	..	.....	..	.....	1	0.36
Plain Corrugated	..	.....	..	.....	..	.....	19	6.83
Reserve Indented Corrugated	..	.....	..	.....	..	.....	17	6.12
Plain and Indented Corrugated	..	.....	..	.....	..	.....	1	0.36
Tularosa Fillet Rim	..	.....	..	.....	..	.....	1	0.36
Alma Scored	..	.....	..	.....	..	.....	2	0.72
La Plata Black-on-Gray	..	.....	..	.....	..	.....	1	0.36
Mogollon Red-on-Brown	..	.....	..	.....	..	.....	12	4.32
Mimbres Bold Face Black-on-White	..	.....	..	.....	..	.....	1	0.36
Reserve Black-on-White	..	.....	..	.....	..	.....	3	1.08
Tularosa Black-on-White	..	.....	..	.....	..	.....	3	1.08
Puerco Black-on-White	..	.....	..	.....	..	.....	2	0.72
Gray Slipped Interior	..	.....	..	.....	..	.....	1	0.36
Fiber Tempered	..	.....	..	.....	..	.....	3	1.08
Total	14	99.99	13	100.00	5	100.00	278	100.01

TABLE 1.—SHERD ANALYSIS (*continued*)

SQUARE 3R1*

	Level 1		Level 2		Level 3		Level 4		Level 5	
	No.	%	No.	%	No.	%	No.	%	No.	%
Alma Plain	36	47.37	43	64.18	36	48.65	72	70.59	77	61.60
Alma Rough	..	.....	1	1.49	2	2.70	..	.....	..	.....
San Francisco Red	12	15.79	4	5.97	5	6.76	10	9.80	14	11.20
Reserve Smudged	6	7.89	3	4.48	3	4.05	3	2.94	..	.....
Alma Neck Banded	..	.....	..	.....	..	.....	2	1.96	3	2.40
Plain Corrugated	2	2.63	1	1.49	4	5.41	3	2.94	6	4.80
Reserve Indented Corrugated	10	13.16	6	8.96	11	14.86	2	1.96	9	7.20
Tularosa Fillet Rim	2	2.63	1	1.49	..	.....	..	.....	1	0.80
Alma Scored	..	.....	..	.....	1	1.35	..	.....	..	.....
La Plata Black-on-Gray	..	.....	1	1.49	..	.....	1	0.98	..	.....
Mogollon Red-on-Brown	5	6.58	6	8.96	8	10.81	6	5.88	6	4.80
Three Circle Red-on-White	..	.....	1	1.49	..	.....	..	.....	2	1.60
Reserve Black-on-White	..	.....	..	.....	1	1.35	..	.....	1	0.80
Smudged Decorated	..	.....	..	.....	3	4.05	1	0.98	2	1.60
Tularosa Black-on-White	3	3.95	..	.....	..	.....	..	.....	2	1.60
Red-on-Black	..	.....	..	.....	..	.....	..	.....	1	0.80
Kiatuthlanna Black-on-White	..	.....	..	.....	..	.....	..	.....	..	.....
Indeterminate	..	.....	..	.....	..	.....	1	0.98	..	.....
Fiber Tempered	..	.....	..	.....	..	.....	1	0.98	1	0.80
St. Johns Polychrome	..	.....	..	.....	..	.....	..	.....	..	.....
Total	76	100.00	67	100.00	74	99.99	102	99.99	125	100.00

* Nine levels dug.

Table 1.—SHERD ANALYSIS (*continued*)

Square 3R1 (*concluded*)

	Level 6		Level 7		Level 8		Level 9		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
Alma Plain	85	64.89	12	60.00	..	.....	7	70.00	368	60.33
Alma Rough	9	6.87	1	5.00	..	.....	..	.....	13	2.13
San Francisco Red	17	12.98	3	15.00	..	.....	1	10.00	66	10.82
Reserve Smudged	..	.....	..	.....	..	.....	..	.....	15	2.46
Alma Neck Banded	1	0.76	..	.....	..	.....	..	.....	6	0.98
Plain Corrugated	2	1.53	..	.....	..	.....	..	.....	18	2.95
Reserve Indented Corrugated	6	4.58	..	.....	..	.....	..	.....	44	7.21
Tularosa Fillet Rim	..	.....	1	5.00	..	.....	..	.....	5	0.82
Alma Scored	..	.....	..	.....	1	20.00	..	.....	2	0.33
La Plata Black-on-Gray	..	.....	..	.....	..	.....	..	.....	2	0.33
Mogollon Red-on-Brown	9	6.87	3	15.00	3	60.00	2	20.00	48	7.87
Three Circle Red-on-White	..	.....	..	.....	..	.....	..	.....	3	0.49
Reserve Black-on-White	..	.....	..	.....	..	.....	..	.....	2	0.33
Smudged Decorated	1	0.76	..	.....	..	.....	..	.....	7	1.15
Tularosa Black-on-White	..	.....	..	.....	..	.....	..	.....	5	0.82
Red-on-Black	..	.....	..	.....	..	.....	..	.....	1	0.16
Kiatuthlanna Black-on-White	..	.....	..	.....	1	20.00	..	.....	1	0.16
Indeterminate	..	.....	..	.....	..	.....	..	.....	1	0.16
Fiber Tempered	..	.....	..	.....	..	.....	..	.....	2	0.33
St. Johns Polychrome	1	0.76	..	.....	..	.....	..	.....	1	0.16
Total	131	100.00	20	100.00	5	100.00	10	100.00	610	99.93

TABLE 1.—SHERD ANALYSIS (*continued*)

SQUARE 4L1*

	Level 1		Level 2		Level 3		Total	
	No.	%	No.	%	No.	%	No.	%
Alma Plain	17	33.33	30	33.33	43	41.75	90	36.89
Alma Rough	..	.....	3	3.33	..	.....	3	1.23
San Francisco Red	7	13.73	11	12.22	13	12.62	31	12.70
Reserve Smudged	7	13.73	20	22.22	27	26.21	54	22.13
Alma Neck Banded	..	.....	..	.....	2	1.94	2	0.82
Plain Corrugated	3	5.88	9	10.00	3	2.91	15	6.15
Reserve Indented Corrugated	6	11.76	5	5.56	3	2.91	14	5.74
Plain and Indented Corrugated	3	5.88	1	1.11	2	1.94	6	2.46
Tularosa Fillet Rim	2	3.92	1	1.11	..	.....	3	1.23
Lino Gray	2	3.92	3	3.33	2	1.94	7	2.87
Mogollon Red-on-Brown	1	1.96	2	2.22	4	3.88	7	2.87
Reserve Black-on-White	1	1.96	3	3.33	..	.....	4	1.64
Smudged Decorated	..	.....	..	.....	2	1.94	2	0.82
Tularosa Black-on-White	1	1.96	..	.....	1	0.97	2	0.82
Red-on-Black	..	.....	2	2.22	1	0.97	3	1.23
Fiber Tempered	1	1.96	..	.....	..	.....	1	0.41
Total	51	99.99	90	99.98	103	99.98	244	100.01

* Three levels dug.

TABLE 1.—SHERD ANALYSIS (*concluded*)

SQUARE 6R1*

	Level 1		Level 2		Level 3		Level 4		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
Alma Plain	10	16.39	19	39.58	12	48.00	2	13.33	43	28.86
San Francisco Red	..	.....	4	8.33	2	8.00	2	13.33	8	5.37
Reserve Smudged	10	16.39	14	29.17	5	20.00	10	66.67	39	26.17
Plain Corrugated	15	24.59	4	8.33	2	8.00	1	6.67	22	14.77
Incised Corrugated	1	1.64	..	.....	..	.....	..	.....	1	0.67
Reserve Indented Corrugated	15	24.59	2	4.17	..	.....	..	.....	17	11.41
Plain and Indented Corrugated	2	3.28	..	.....	..	.....	..	.....	2	1.34
Tularosa Fillet Rim	4	6.56	..	.....	..	.....	..	.....	4	2.68
Mogollon Red-on-Brown	..	.....	1	2.08	3	12.00	..	.....	4	2.68
Mimbres Classic Black-on-White	..	.....	..	.....	1	4.00	..	.....	1	0.67
Reserve Black-on-White	..	.....	1	2.08	..	.....	..	.....	1	0.67
Tularosa Black-on-White	4	6.56	..	.....	..	.....	..	.....	4	2.68
Indeterminate	..	.....	2	4.17	..	.....	..	.....	2	1.34
Fiber Tempered	..	.....	1	2.08	..	.....	..	.....	1	0.67
Total	61	100.00	48	99.99	25	100.00	15	100.00	149	99.98

* Eight levels dug; four contained no pottery.

TABLE 2.—SHERD ANALYSIS, CORDOVA CAVE

Square 1R1

	Level 1		Level 2		Level 3		Total	
	No.	%	No.	%	No.	%	No.	%
Alma Plain	8	61.54	.	......	3	100.00	11	64.71
San Francisco Red	1	7.69	.	......	.	......	1	5.88
Reserve Smudged	..	......	1	100.00	.	......	1	5.88
Reserve Indented Corrugated	3	23.07	.	......	.	......	3	17.65
Kiatuthlanna Black-on-White	1	7.69	.	......	.	......	1	5.88
Total	13	99.99	1	100.00	3	100.00	17	100.00

Square 1L1

	Level 1		Level 2		Level 3		Level 4	
	No.	%	No.	%	No.	%	No.	%
Alma Plain	3	75.00	2	66.67	2	50.00	9	100.00
Reserve Indented Corrugated	1	25.00	1	33.33	2	50.00	.	......
Total	4	100.00	3	100.00	4	100.00	9	100.00

	Level 5		Level 6		Level 7		Total	
Alma Plain	5	100.00	2	100.00	3	100.00	26	86.67
Reserve Indented Corrugated	..	......	..	......	.	......	4	13.33
Total	5	100.00	2	100.00	3	100.00	30	100.00

Square 2R1

	Level 1		Total	
	No.	%	No.	%
Alma Plain	12	57.14	12	57.14
San Francisco Red	4	19.05	4	19.05
Three Circle Neck Corrugated	3	14.29	3	14.29
Reserve Indented Corrugated	2	9.52	2	9.52
Total	21	100.00	21	100.00

TABLE 2.—SHERD ANALYSIS (*continued*)

Square 2L1

	Level 1		Level 2		Level 3		Level 4		Level 5		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Alma Plain	10	83.33	1	25.00	5	100.00	2	100.00	1	100.00	19	79.17
San Francisco Red	1	8.33	..	.....	..	.....	..	.....	..	.....	1	4.17
Reserve Indented Corrugated	1	8.33	2	50.00	..	.....	..	.....	..	.....	3	12.50
Tularosa Fillet Rim	.	.....	1	25.00	..	.....	..	.....	..	.....	1	4.17
Total	12	99.99	4	100.00	5	100.00	2	100.00	1	100.00	24	100.01

Squares 3L1 and 3R1

	Level 1		Level 2		Level 3		Level 4		Level 5		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Alma Plain	5	83.33	7	70.00	17	73.91	5	100.00	1	100.00	35	77.78
San Francisco Red	1	16.67	..	.....	3	13.04	..	.....	..	.....	4	8.89
Reserve Smudged	.	.....	2	20.00	2	8.70	..	.....	..	.....	4	8.89
Reserve Indented Corrugated	.	.....	1	10.00	1	4.35	..	.....	..	.....	2	4.44
Total	6	100.00	10	100.00	23	100.00	5	100.00	1	100.00	45	100.00

Square 4R1

	Level 1		Level 2		Level 3		Level 4		Level 5	
	No.	%	No.	%	No.	%	No.	%	No.	%
Alma Plain	..	.....	8	88.89	2	50.00	3	75.00	..	.....
San Francisco Red	..	.....	1	11.11	2	50.00	1	25.00	..	.....
Plain Corrugated	..	.....	..	.....	..	.....	..	.....	..	.....
Total	..	.....	9	100.00	4	100.00	4	100.00	..	.....

	Level 6		Level 7		Level 8		Level 9		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
Alma Plain	..	.....	..	.....	..	.....	2	100.00	15	71.43
San Francisco Red	..	.....	..	.....	..	.....	..	.....	4	19.05
Plain Corrugated	..	.....	..	.....	2	100.00	..	.....	2	9.52
Total	..	.....	..	.....	2	100.00	2	100.00	21	100.00

TABLE 2.—SHERD ANALYSIS (*continued*)

Square 4L1

	Level 1		Level 2		Level 3		Level 4		Level 5		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Alma Plain	11	78.57	7	53.85	11	91.67	5	100.00	..	......	34	75.56
San Francisco Red	..	.....	2	15.38	1	8.33	..	......	..	......	3	6.67
Reserve Indented Corrugated	3	21.43	4	30.77	..	.....	..	......	1	100.00	8	17.78
Total	14	100.00	13	100.00	12	100.00	5	100.00	1	100.00	45	100.01

Square 5R1

	Level 1		Level 2		Level 3		Level 4		Level 5		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Alma Plain	16	94.12	30	96.77	24	92.31	..	......	2	100.00	72	94.74
San Francisco Red	..	.....	1	3.23	1	3.85	..	......	..	......	2	2.63
Reserve Smudged	..	.....	..	.....	1	3.85	..	......	..	......	1	1.32
Reserve Indented Corrugated	1	5.88	..	.....	..	.....	..	......	..	......	1	1.32
Total	17	100.00	31	100.00	26	100.01	..	......	2	100.00	76	100.01

Square 5L1

	Level 1		Level 2		Level 3		Total	
	No.	%	No.	%	No.	%	No.	%
Alma Plain	5	55.56	9	90.00	5	100.00	19	79.17
San Francisco Red	1	11.11	.	.....	.	......	1	4.17
Reserve Smudged	1	11.11	1	10.00	.	......	2	8.33
Reserve Indented Corrugated	2	22.22	.	......	.	......	2	8.33
Total	9	100.00	10	100.00	5	100.00	24	100.00

TABLE 2.—SHERD ANALYSIS (*continued*)

Square 6R1

	Level 1		Level 2		Level 3		Total	
	No.	%	No.	%	No.	%	No.	%
Alma Plain	24	82.76	9	81.82	1	100.00	34	82.93
Reserve Smudged	2	6.90	1	9.09	.	......	3	7.32
Reserve Indented Corrugated	3	10.34	.	......	.	......	3	7.32
Indeterminate	..	.....	1	9.09	.	......	1	2.44
Total	29	100.00	11	100.00	1	100.00	41	100.01

Square 6L1

	Level 1		Level 2		Level 3		Total	
	No.	%	No.	%	No.	%	No.	%
Alma Plain	9	50.00	3	100.00	1	100.00	13	59.10
San Francisco Red	2	11.11	.	......	.	......	2	9.10
Three Circle Neck Corrugated	6	33.33	..	......	.	......	6	27.27
Indeterminate	1	5.56	.	......	.	......	1	4.55
Total	18	100.00	3	100.00	1	100.00	22	100.02

Square 6R2 and Tunnel

	Level 1		Level 2		Total	
	No.	%	No.	%	No.	%
Alma Plain	26	96.30	26	83.87	52	89.66
Reserve Smudged	..	.....	3	9.68	3	5.17
Puerco Black-on-White	..	.....	1	3.23	1	1.72
Indeterminate	1	3.70	1	3.23	2	3.45
Total	27	100.00	31	100.01	58	100.00

TABLE 2.—SHERD ANALYSIS (*continued*)

Square 7R1

	Level 1		Level 2		Level 3		Level 4		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
Alma Plain	6	100.00	1	100.00	3	100.00	2	100.00	12	100.00

Square 7L1

	Level 1		Level 2		Level 3		Level 4		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
Alma Plain	4	100.00	....	..	....	......	2	100.00	6	100.00

Square 7R2

	Level 1		Level 2		Level 3		Level 4		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
Alma Plain	7	77.78	9	100.00	11	100.00	8	100.00	35	94.59
San Francisco Red	1	11.11	..	......	..	......	..	......	1	2.70
Three Circle Neck Corrugated	1	11.11	..	......	..	......	..	......	1	2.70
Total	9	100.00	9	100.00	11	100.00	8	100.00	37	99.99

TABLE 2.—SHERD ANALYSIS (*continued*)

Square 8R1

	Level 1		Level 2		Level 3		Level 4	
	No.	%	No.	%	No.	%	No.	%
Alma Plain	12	54.55	18	69.23	11	84.62	1	100.00
San Francisco Red	1	4.55	..	......	..	......	..	......
Plain Corrugated	..	.....	1	3.85	1	7.69	..	......
Reserve Indented Corrugated	8	36.36	5	19.23	1	7.69	..	......
Mimbres Bold Face Black-on-White	1	4.55	2	7.69	..	......	..	......
Total	22	100.01	26	100.00	13	100.00	1	100.00

	Level 5		Level 6		Level 7		Level 8		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
Alma Plain	4	100.00	4	100.00	..	......	..	......	50	69.44
San Francisco Red	.	......	..	......	..	......	..	......	1	1.39
Plain Corrugated	.	......	..	......	..	......	..	......	2	2.78
Reserve Indented Corrugated	.	......	..	......	..	......	2	100.00	16	22.22
Mimbres Bold Face Black-on-White	.	......	..	......	..	......	..	......	3	4.17
Total	4	100.00	4	100.00	..	......	2	100.00	72	100.00

Square 8L1

	Level 1		Level 2		Level 3		Total	
	No.	%	No.	%	No.	%	No.	%
Alma Plain	37	97.37	7	77.78	.	......	44	89.80
Three Circle Neck Corrugated	1	2.63	2	22.22	1	50.00	4	8.16
Reserve Indented Corrugated	..	.....	.	......	1	50.00	1	2.04
Total	38	100.00	9	100.00	2	100.00	49	100.00

TABLE 2.—SHERD ANALYSIS (*continued*)

Square 8R2

	Level 1		Level 2		Total	
	No.	%	No.	%	No.	%
Alma Plain	5	83.33	5	71.43	10	76.92
Plain Corrugated	1	16.67	..	.....	1	7.69
Reserve Indented Corrugated	..	.....	2	28.57	2	15.38
Total	6	100.00	7	100.00	13	99.99

Square 9R1

	Level 1		Level 2		Level 3		Level 4	
	No.	%	No.	%	No.	%	No.	%
Alma Plain	8	50.00	11	68.75	10	71.43	5	100.00
Alma Rough	..	.....	..	.....	1	7.14	..	.....
San Francisco Red	1	6.25	..	.....	..	.....	..	.....
Plain Corrugated	..	.....	..	.....	2	14.29	..	.....
Three Circle Neck Corrugated	..	.....	1	6.25	..	.....	..	.....
Reserve Indented Corrugated	6	37.50	4	25.00	1	7.14	..	.....
Mimbres Classic Black-on-White(?)	1	6.25	..	.....	..	.....	..	.....
Total	16	100.00	16	100.00	14	100.00	5	100.00

	Level 5		Level 6		Level 7		Level 8		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
Alma Plain	2	100.00	..	.....	..	.....	1	100.00	37	68.52
Alma Rough	..	.....	..	.....	..	.....	..	.....	1	1.85
San Francisco Red	..	.....	..	.....	..	.....	..	.....	1	1.85
Plain Corrugated	..	.....	..	.....	..	.....	..	.....	2	3.70
Three Circle Neck Corrugated	..	.....	..	.....	..	.....	..	.....	1	1.85
Reserve Indented Corrugated	..	.....	..	.....	..	.....	..	.....	11	20.37
Mimbres Classic Black-on-White	..	.....	..	.....	..	.....	..	.....	1	1.85
Total	2	100.00	..	.....	..	.....	1	100.00	54	99.99

TABLE 2.—SHERD ANALYSIS (*concluded*)

Square 9L1

	Level 1		Level 2		Total	
	No.	%	No.	%	No.	%
Alma Plain	5	100.00	5	55.56	10	71.43
Reserve Smudged	..	.....	3	33.33	3	21.43
Three Circle Neck Corrugated	..	.....	1	11.11	1	7.14
Total	5	100.00	9	100.00	14	100.00

Square 9R2

	Level 1		Level 2		Level 3		Total	
	No.	%	No.	%	No.	%	No.	%
Alma Plain	3	50.00	..	.....	1	100.00	4	57.14
Reserve Smudged	1	16.67	..	.....	..	......	1	14.29
Three Circle Neck Corrugated	1	16.67	..	.....	..	......	1	14.29
Reserve Indented Corrugated	1	16.67	..	.....	..	......	1	14.29
Total	6	100.01	..	.....	1	100.00	7	100.01

Squares 10R1 and 10L1

	Level 1		Level 2		Level 3		Level 4		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
Alma Plain	9	60.00	8	57.14	4	80.00	1	20.00	22	56.41
Reserve Smudged	1	6.67	..	.....	..	.....	4	80.00	5	12.82
Reserve Indented Corrugated	3	20.00	2	14.29	1	20.00	..	......	6	15.38
Indeterminate Black-on-White	2	13.33	4	28.57	..	.....	..	......	6	15.38
Total	15	100.00	14	100.00	5	100.00	5	100.00	39	99.99

IV. Specimens of Stone, Bone, and Clay

By JOHN B. RINALDO

On pages 121–198 the details of the artifacts are given in outline form. For convenience in comparison the specimens have been grouped as follows:

LIST OF ARTIFACTS

Object	Number Excavated	
Ground and Pecked Stone	Tularosa Cave	Cordova Cave
Handstones		
Manos	47	40
Rubbing stones	50	12
Polishing stones	13	7
Pestles	4	0
Milling stones		
Metates	26	16
Small, metate-like grinding stones	5	0
Paint grinding stones	7	0
Mortar	1	0
Worked slabs	2	1
Hammerstones	11	26
Abrading stones	7	1
Awl sharpeners	6	0
Stone balls	18	0
Pipes	2	1
Foot effigies	2	0
Chipped Stone		
Projectile points and blades	370	383
Knives	392	455
Scrapers	402	384
Choppers	117	102
Drills	32	30
Gravers	0	11
Saws	4	0
Hoes	5	0
Polished Stone		
Atlatl charms	5	0
Pendants	4	0
Shell		
Bracelets	2	1
Beads	2	1

Bone		
Awls	30	30
Punches	4	0
Fleshers	5	1
Flakers	1	2
Weaving tools	2	0
Tubes	5	7
Dice	5	5
Pendants	1	1
Notched ribs	0	3
Dart bunt	0	1
Antler		
Flakers	0	5
Rubbers	0	3
Cup	1	0
Clay		
Worked sherds	2	2
Figurines	3	0
Animal effigies	3	0
Cornucopia	3	0
Phallic images	3	0
Spindle whorls	5	0
Miniature ladles	2	0
Pot covers	3	0
Clay balls	0	3
Unworked Stone		
Pigments	13	6
Crystals	1	2
Total number	1628	1542

Discussion

One of the main interests in the study of the artifacts from Tularosa and Cordova caves was to interpret from them such inferences as we could make concerning the way in which the Mogollon people made their living. This will be considered under four headings: (1) Methods of working tools; (2) their uses; (3) their relation to the problem of obtaining the necessities of life, such as food, clothing, and shelter; and (4) a comparison of the cave artifacts with similar objects from other horizons—trait distributions in time and space.

Methods of Working Tools

GROUND AND PECKED

An examination of the marks made in the process of manufacture of the stone artifacts reveals a group that has scratched, smoothed, and dimpled surfaces. These are the characteristic marks left when stone is shaped by grinding and pecking, and consequently the implements that show such marks have been grouped under the heading "Ground and Pecked Stone."

There is considerable variation within the categories such as manos, rubbing stones and metates, in the degree to which they have been shaped by this method. Some have been completely changed from their original state as raw material and all of their surfaces show marks of pecking and grinding, whereas others have simply a limited area of surface that is dimpled, smooth, or battered. In some instances this appearance of the working surface is only the result of use; in others it is the result of some intentional shaping, such as the roughening of milling surfaces to improve their grinding efficacy.

Many of the manos, particularly the tabular and the beveled manos (which were found mostly in the upper levels of the cave), were modified both on their broad surfaces and their edges. Other types of manos and the majority of the rubbing stones and polishing stones have only their working surfaces smoothed as the result of use in grinding, rubbing, or polishing. The remainder of their surfaces is that of the natural pebbles from which they were made. The pestles appear to have been selected for their suitability in shape and size for the use intended, but these tools show only a few pecked flat surfaces and battered ends. The bottom and sides of all the metate slabs also remained unworked.

On the other hand there are, other than manos, a few objects which indicate that the occupants of the caves were capable of more careful work. Examples of such objects are the foot effigies, which have been carefully shaped and smoothed on all of their surfaces.

On the basis of analogy and experiment it may be inferred that the hammerstones and the coarse abrasive stones of the cave neighborhood were used in the shaping of the ground and pecked stone implements and artifacts.

CHIPPED IMPLEMENTS

The range of workmanship on the chipped implements is equally wide. Most of the flake knives and scrapers are merely random flakes of varying thicknesses that were selected as suitable for cutting or scraping. The nibble-like chipping on many of these flake knives is quite possibly the result of use rather than intentional chipping. Other knives and scrapers have been retouched on one or more edges to a greater extent and with some uniformity of direction. In general, the scrapers show more of this sharpening than do the knives. Many scrapers show secondary chipping all over at least one major surface and some show it on both surfaces. The convex surface more frequently shows this secondary chipping than does the flat surface.

In the degree of workmanship the scrapers and choppers are alike. The choppers vary from ordinary flinty pebbles with one side sharpened to an edge by flaking, to those that have been chipped on all their surfaces. One or two of those choppers which retain some of the original surface of the natural pebble for a grip have had the corners of this natural surface ground off on a bevel, probably to make the tool more easily grasped. Such choppers might be classified with the ground stone implements.

The projectile points, blades, and drills show the most careful workmanship of all the chipped stone implements. Many show fine pressure chipping on all of their surfaces and are delicately and symmetrically shaped. However, there are also many that are thick and asymmetrical, with only quite coarse chipping. It seems probable that the coarser quality of some of the chipping is due more to the limitations of the raw material at hand than to the method of chipping. Many of these artifacts are made of basalt or rhyolite, which lacks the even conchoidal fracture of stones such as obsidian and the more uniform cherts. There is no perceptible general improvement or decline in the quality of chipping between the various levels of the two caves.

It seems probable, on the basis of analogy, experiment, and the marks of use, that the bone flaker and the punches and the hammerstones found in the cave were the tools used to form these chipped artifacts.

STONE ORNAMENTS AND PIPES

Like the foot effigies and the finer projectile points, considerable care seems to have been taken in shaping the pendants and pipes. Their smooth exteriors and symmetrical shapes suggest that their makers had taken some interest in the manufacture of these objects. Some are polished smooth, and earlier marks of shaping are obliterated. It is possible that the abrading stones, such as were found in the caves, could have been used for part of this process of smoothing and shaping.

SHELL

The shell bracelets, like the others described (Martin and Rinaldo, 1950b, pp. 451, 492), were either cut or sawed from a bivalve shell

(*Glycymeris gigantea*). The cut surface is smooth and straight, and there are no marks of the cutting tool. The shell beads and the pendant have also been cut to shape and then drilled to provide a hole for stringing. The bracelet fragments have polished surfaces.

BONE

The bone implements and other objects of bone such as the dice and tubes exhibit minute parallel scratches and smooth, polished surfaces. It seems possible that the larger implements were made from long bones that were split by sawing a groove with a stone blade and then wedging the broken sections apart when the groove was deep enough. The working ends such as the points of the awls could then be cut, ground, and polished to shape.

Although many of these implements were made from fragments or splinters, others were made from bones more carefully worked so that the head of the bone remains as a handle.

By analogy it seems probable that the stone knives, saws, awl sharpeners, and abrading stones from the site could have been used in this process.

CLAY ARTIFACTS

The clay artifacts on the whole are rather crude. In comparison with the pottery vessels the clay has been manipulated in a relatively slipshod manner. The tempering material is either quite coarse or is left out of the clay entirely. Some of these objects were not even fired. The jar and basket covers are simply circular lumps of clay which have been forced when wet and plastic into the mouth of the jar or basket. They still retain the impression of the basket or jar rim and the top layer of the bast or other material inside. Some of the bast that formed the top layer still sticks to one of these covers.

The figurines and animal effigies were crudely modeled and bear only a general likeness to human or animal figures. Although there are differences in the animal figures, the characteristics are so crudely portrayed that identification of the animal represented is sheer guesswork.

The cornucopias are roughly modeled and decorated with incised lines and punctate dots done with some round pointed tool when the clay was wet and plastic. This tool could have been a twig, an awl, or even a straw.

The modeled spindle whorls were molded of wet clay right on the twig spindle, as may be seen by the fact that portions of the spindle still adhere to the edges of the holes in the centers of the whorls.

The worked sherds were shaped by abrasion, perhaps by rubbing the edge of one sherd against another.

Uses of Artifacts

Some possible uses of these artifacts may be safely inferred by historic analogy. These uses and marks of use are given above. Others may be inferred from evidence such as associations in situ; for example, a few manos were found in association with metates, indicating that they were used together. One of these was a disk type mano in association with a basin metate in one of the lower levels (Field Numbers 1847 and M, Square 3R2, Level 10, Pine Lawn Phase).

Two of the clay pot covers still retain the impressions of the material held in the containers over which the clay was pressed. Sunflower seeds and fiber still stick to the bottom of one which has the impression of a coiled basket rim on its edge. Another specimen appears also to have been used as a cover for a narrow-mouthed basket, but the impression is blurred.

Two bone awls were found thrust into the ends of a coil of basketry splints. This suggests the use of bone awls in weaving. One of these awls has a fiber knob handle.

A slender diagonal notched point and a large lateral notched point (Field Numbers 868, 1698) were found hafted as atlatl dart points. Bases of other stone points were found mounted in the notches of atlatl dart foreshafts. No stone arrow points were found hafted in arrow foreshafts, although occasional arrow foreshafts were notched so that small projectile points could have been hafted. One broken projectile point had been mended by binding the pieces together with sinew. Another projectile point has a sinew binding around its base.

Scrapers and choppers were found with bits of tissue adhering to their cutting edges. The structure of these tissues was examined microscopically by Mr. D. Dwight Davis of the Department of Zoology and by Dr. Hugh C. Cutler of the Department of Botany. They were identified as plant and animal tissue. Only the larger scrapers were found with this material on their edges. It was thought at first to be animal tissue and hair, when examined megascopically. A number of such scrapers are simply utilized flakes without any chipping other than that resulting from use.

Marks of a saw-like implement with evenly spaced teeth were found on some of the wood and bone specimens. These marks are closely spaced parallel scratches or grooves. They were found as deep as Pine Lawn Phase levels and Pre-Pottery Period levels.

A complete pipe was found with burned dottle in the bowl and a bone tubular stem in the lower end. It is possible that some of the other bone tubes of similar size could have been used as pipe stems.

The spindle whorls of the modeled clay type had fragments of what were possibly spindle sticks remaining in the perforation. None were found with yarn on them.

Artifacts in Their Relation to Subsistence

Viewed alone, and ignoring the waste products of the economy, the artifacts could give a somewhat distorted picture of the subsistence of the cave dwellers. For one thing, the ratio of projectile points and chipped stone implements to milling stones and ground stone implements is high on the side of the chipped stone implements. This might lead one to believe that hunting provided a large part of the Mogollon subsistence and that gathering and agriculture played a rather minor role. On the other hand, waste products of vegetable food—corn cobs, yucca pods, squash rinds and stems, bean pods, nut shells and primrose roots, grass bundles and the like—comprised a much larger volume of the refuse than did animal bone. (Thirty-eight cartons of vegetable materials were gathered and only six cartons of unworked bone.) Thus, it seems probable that vegetable foods had the more prominent place in the economy.

Of the 370 projectile points and blades recovered from Tularosa Cave, 156 were fragmentary. Of these fragments 111 are fragments of bases and only 45 fragments of tips. This proportion suggests that the occupants of the cave hunted out from it and brought their arrows and darts back for replacement of the broken heads.

An interesting sidelight in this connection is that the greater number of broken tips and bases were recovered from Pre-Pottery levels, and that on the average they are rather large (more than 2.5 cm.). Now the general proportions of these fragments indicate that the whole specimens from which they came must have been at least twice as large (more than 5 cm. long), in fact too large for efficient use. After some experimentation, Browne (1940, p. 209) reported concerning blades over 50 mm. in length, "The long blades are difficult to make, the thickness and width are too great for ready penetration, breakage would be heavy, and with very few exceptions the large type of blades are of a width that tends to very poor hafting." It might be inferred from this that the greater number of fragments in Pre-Pottery levels indicates a period of trial and error in making projectile points and blades.

The animal effigy figures might also suggest that game animals were at least as important to these ancient peoples as they are to the modern tribes that use very similar figures as fetiches, and the foot effigies (which resemble bear paws and could have been used for sympathetic magic) lend credence to this idea.

There also appears to be a greater heterogeneity of unrelated types of projectile points than there is, for example, on most Anasazi sites, and in general the chipping technique tends to be more coarse than fine. These short comings in the chipped stone industry might be interpreted as reflections of lack of interest in hunting.

Many of the manos were fragmentary, as were a fair number of the metates. None of the metates were "killed" in the sense that a hole was broken through the grinding surface "to release the spirit," although a similar practice is suggested by the broken condition of the finds.

Distribution of Traits

With very few exceptions the cave artifacts made of stone, bone, shell, or baked clay have their counterparts in the collections from the open sites in the Pine Lawn Valley. Such differences as exist seem largely due to differences in the available raw material rather than to cultural differences. The exceptions are the foot effigies, the atlatl charm stones, and the antler cup.

In general the manos are short and could only be used in one hand. A few long, two-hand manos occur in the lower levels, but the majority of the longer manos occur in the upper levels. The proportion of manos with two grinding surfaces to those with one grinding surface increases towards the top of the midden; for example, in Tularosa Cave the ratio changes from 6:3 in the Pre-Pottery levels to 1:7 from the Reserve-through-Tularosa levels. In the San Francisco levels the ratio is 4:7 and from the San Francisco-through-Tularosa levels it is 6:6. In both caves the disk type and the ovoid mano are more common in the earlier levels, the rectangular mano in the later levels. Beveled manos came only from the late levels in Tularosa Cave.

The greatest frequency of polishing stones occurs in the levels where plain pottery predominates and then decreases in frequency in the later levels, roughly in inverse ratio to the increase in the amount of corrugated wares. Two polishing stones were found in the Pre-Pottery levels of the shallower stratigraphic columns toward the back and west side of Tularosa Cave. Their presence in the Pre-Pottery levels might be explained as due to the normal amount of mixing expected in dry middens (one was in the vicinity of a burial); or these stones may have had some other function than that of polishing pottery.

The late manos were beveled differently from the Ventana Cave manos (Haury, 1950, p. 313, Fig. 72). On the Ventana Cave manos, the ridge, between the beveled portions of the surface, is rounded or flat on top, whereas the Tularosa Cave beveled manos are like those from the Reserve Phase open sites (Martin and Rinaldo, 1950b, pp. 450–451) in which the bevels are separated only by a longitudinal sharp ridge. This type of mano is more common on late Pueblo III and IV sites than on earlier sites, but they do occur on Pueblo II sites in the Flagstaff area (Bartlett, 1934, pp. 27–28).

A few manos were found with a tendency to be wedge-shaped in cross section, and a few had pits (finger grips) in the center of the upper surface. These are common features of manos throughout the Southwest.

The smaller disk and sub-rectangular manos of the lower levels bear some resemblance to the Chiricahua types of the Arizona Cochise (Sayles and Antevs, 1941, pp. 17–18, Pl. IX) and the Wet Leggett Cochise (Martin, Rinaldo, and Antevs, 1949, p. 66). They are also generally similar to the Basketmaker II handstones from White Dog Cave (Guernsey and Kidder, 1921, p. 93, Pl. 38, *d*, *e*, *f*). However, the resemblance to the Cochise specimens, especially in the nature of the grinding surface, is greater. In this respect they also resemble the Pinto Basin manos (Amsden, 1935, Pl. 7).

The metate types follow trends similar to those outlined for the open sites (Martin and Rinaldo, 1950b, Fig. 221). The slab type has a fairly even distribution from early to late. In some cases these slab or plain surface metates might be classed as entirely new basin or trough type metates and it is certain that they constitute for the most part the beginning stage or raw material for the other types. Frequently the outlines of a trough or basin may be seen pecked out on the grinding surface to roughen it. However, they were all classed as slab metates, whether the grinding surface had been outlined or not, because the distinction was uncertain. The basin type metate was most common in the early phases and later it gradually declined in popularity. The shallow basin and deep basin Chiricahua types (Sayles and Antevs, 1941, p. 18) were both present. These are the same types found on the Wet Leggett (Martin, Rinaldo, and Antevs, 1949, pp. 62, 68). They are also similar to the Ventana Cave metates (Haury, 1950, pp. 305–308). The absence of the trough metates with both ends open from this cave sequence is somewhat puzzling in view of the presence of beveled manos and the other artifacts normally expected in the assemblages of the Reserve and Tularosa phases. The trough type with one end open is more common in the middle levels than earlier.

This type of metate has a wide distribution. Although it occurs in the earlier pottery periods (Pine Lawn and Georgetown phases) it does not attain its greatest frequency until later. Variations of this type appear throughout the Southwest (Woodbury, 1939, p. 67). Although they have been recovered from Pueblo III sites (Morris, 1919, p. 29; Pepper, 1920, Fig. 29), there is good evidence that they declined in popularity after Pueblo I (Rinaldo, 1950, pp. 100–101). The Anasazi variety can be differentiated from the Mogollon variety by several characteristics such as a flatter shelf at the closed end, and a more rectangular straight-sided trough. The rounded contours of the Mogollon trough metate distinguish it from the angular contours of the Anasazi metate, which is also frequently made of sedimentary rock as contrasted with the more common igneous material found in the Mogollon metates. None of the metates from Tularosa Cave had the shelf receptacle for the mano characteristic of the "Utah" type metate that was found at Forestdale (Haury, 1940, p. 98) and at Turkey Foot Ridge (Martin and Rinaldo, 1950a, p. 318).

A boulder mortar was found in the deep Georgetown Phase levels. This type of mortar often occurs in the form of cup-like depressions in the grinding surfaces of metates. In either form it is a type peculiar to Mogollon sites in the Southwest. It has been reported from the SU Site (Martin, 1939, p. 42), the Cave Creek Village (Sayles, 1945, p. 50, footnote), the San Simon Village (Sayles, op. cit., p. 50), the Bluff Site (Haury and Sayles, 1947, p. 77), the Forestdale Village (Haury, 1940, p. 101), the Starkweather Site (Nesbitt, 1938, p. 100), Turkey Foot Ridge Site (Martin and Rinaldo, 1950a, p. 318), and the Alamogordo Sites (Lehmer, 1948, p. 64). As is indicated by this distribution, these mortars are one of the characteristic traits of the Mogollon culture.

We found several paint-grinding stones that bear a superficial resemblance to the proto-palettes of the San Simon Branch (Sayles, 1945, Pl. XLV) and Ventana Cave (Haury, 1950, p. 329). These are simple slabs of stone bearing red or green pigment stains on a flat surface; they are not decorated in any way like the Hohokam palettes. Similar objects were found at the SU Site (Martin, 1943, p. 192). One was recovered from the Pre-Pottery Period in Tularosa Cave, but the majority have a later distribution. The use of palettes by the River Hohokam is one of their outstanding features (Haury, 1950, p. 369). However, the Tularosa Cave specimens are simply utilized slabs and bear at the most a generic resemblance to the highly decorated and carved specimens of these Hohokam. On the other hand, the Anasazi appear to have used a paint cup or mortar for grinding paints (Woodbury, 1939, p. 61; Hibben, *in* Brand and others, 1937, p. 95), so it appears that the distribution of proto-palettes is to the south.

The implements termed "awl sharpeners" bear a superficial resemblance to objects called "arrow shaft smoothers" elsewhere. Therefore, it should be pointed out that the arrow shaft smoothers have straight grooves of regular, uniform width and depth whereas the grooves of the awl sharpeners taper off in width and depth at the ends and cross over one another. They were found only in the pottery levels of the midden. King (1949, p. 93) reports an awl sharpener from Nalakihu.

The stone balls have their greatest frequency in the Pre-Pottery levels, but they were recovered in all levels of the caves. They have a wide distribution throughout the Southwest but possess no particular characteristics in one locality to differentiate them from those in another, nor do they have unusually large frequency in any one site.

The complete tubular stone pipe with bone stem recovered from the caves is similar in every respect to the tubular pipe with bone stem recovered from the SU Site (Martin, 1943, p. 204, Fig. 71). This type of pipe has a southern distribution (Sayles, 1945, pp. 51, 55), for it appears at the Mogollon and Harris Villages (Haury, 1936a, pp. 38, 72, Pls. XV, XXXII), the Starkweather Ruin (Nesbitt, 1938, p. 104, Pl. 45), the Swarts Ruin (Cosgrove, H. S. and C. B., 1932, p. 50), Cameron Creek Ruin (Bradfield, 1931, p. 119, Pl. XCIV), and at other southern sites.

The foot effigy stones bear only a very general resemblance to the sandal last stones of the Anasazi (Kidder and Guernsey, 1919, pp. 105–106; Morris, 1939, pp. 131–132). Although of somewhat the same shape in outline, the foot effigies lack the jog toe, are much thicker, and have all the toes delineated.

Projectile points and blades have been described together, following the general practice in Southwestern archaeological literature. They have been classified into a number of categories, some of which may have value as chronological markers because they had a limited vertical distribution in the midden. Other categories had a distribution from the lowest levels to the top and may have significance only for their spatial distributions in the wider Southwest.

Among the projectile point types with a limited vertical distribution in the cave the category (*a*) of corner notched, thinned concave base points with one serrate edge seems most significant. This type is distinctly reminiscent of the Pinto point (Amsden, 1935, Pl. 7) and the Pinto-Amargosa II points from Ventana Cave (Haury, 1950, p. 284, Figs. 61, *h*, *l*, and 64, *i*); however, it is much smaller in size than most Pinto points and resembles more closely the Wet Leggett point (Martin, Rinaldo, and Antevs, 1949, p. 72, Fig. 17) and the Pinto-like points from the San Augustin Plains (Hurt and McKnight, 1949, pp. 184–185). This type of point was found only in the lower levels of the cave.

Many diagonal notched points (type *b*) with expanding base were found. Of these the small, short, thin points (category *b*-4) have a late distribution in the midden; the longer, more slender, diagonal notched points (category *b*-3) appear to be relatively early (at least Plain Ware horizon, as they occur no later), and the other diagonal notched categories (*b*-1 and *b*-2) were scattered throughout the various levels. It is these other categories, the medium-sized broad and the large points, which are reported as the most common type recovered at the Mogollon Village (59 specimens, Haury, 1936a, p. 42, Fig. XVII). They were the second most common type at the SU Site in the Pine Lawn Phase pit-houses (seven recovered, Martin and Rinaldo, 1950a, p. 356, Table 9). They have been recovered from Reserve Phase sites (Martin and Rinaldo, 1950b, p. 482, Fig. 184, *i*, *j*, *k*), although they are more common during the San Francisco and earlier phases.

Several other types appear to have an early distribution. One of these is a relatively long, lateral notched point with straight to slightly convex expanding base and sharp lateral barbs (category *e*-1, which appeared only in the lower levels). This resembles the most common type of point at the SU Site (Martin and Rinaldo, 1950a, p. 356, Table 9). It also resembles a variant of the San Pedro point found at Ventana Cave (Haury, 1950, p. 290, Fig. 64, *c*, *g*). One of the Tularosa Cave points of this type was found hafted as an atlatl dart point. Because this type of point occurs late in the Pre-Pottery horizons it seems logical to expect that it would survive into the earliest pottery horizons, as it does in modified form.

A shorter, broader variant of this lateral notched point (category *e*-2) occurred in large numbers throughout the Cordova Cave midden. More of these were recovered than of any other type in this cave, and there appears to be a decrease in the frequency of these points from early to late in the midden.

Another lateral notched type was fairly numerous in the Pre-Pottery levels of Cordova Cave. This was a relatively small-sized shallow notched point with a straight base and serrate edges (category *d*). This point is reminiscent of types 8D2 and 9A from the San Augustin Plains sites and Bat Cave (Hurt and McKnight, 1949, Fig. 43; Dick *in* Wormington, 1949, p. 100). Haury reports similar points from Ventana Cave (Haury, 1950, p. 290, Fig. 64, *a*) and classifies them as variants of the Amargosa II (Pinto) series. Hurt and McKnight (op. cit., pp. 184–185) suggest that their classes 8D2 and 9A are related to the Pinto series. The type from the cave collections with a broad, straight stem (category *i*) also may belong to the Pinto related series. It resembles the Type 2 Pinto (Rogers, 1939, p. 54, Pl. 13) and occurred stratigraphically early.

Another type (type *o*), which had a definite distribution in the earlier levels of the caves, is a group of blades with off-center points and straight bases. They are similar to objects termed knives from the SU Site (Martin, 1943, p. 210, Fig. 75, *c*). The flaking on these specimens is relatively coarse.

Additional evidence was found also that the roughly leaf-shaped point with the upper portion of the edges slightly convex and the basal portion straight (category *l*) is an early type limited in distribution to the Pre-Pottery and the earlier pottery horizons. It occurred only in Pre-Pottery, Pine Lawn and Georgetown Phase levels. It is reported from the SU Site and the Promontory Site, both Pine Lawn Phase villages (Martin, 1943, p. 206, Fig. 73, *d*;

Martin and Rinaldo, 1947, p. 344, Fig. 118, *d;* Martin, Rinaldo, and Antevs, 1949, p. 168, Fig. 62, *i*).

Two types of projectile points occurred primarily with a late distribution in the upper levels of the caves. One of these is a small, triangular, lateral notched point (category *s*). Two of the specimens of this type are almost certainly of Pueblo origin. The other is a slender serrate point closely resembling Hohokam points of the Sacaton Phase (Gladwin and others, 1937, Pl. 87); they also occurred at the Swarts Ruin (Cosgrove, 1932, Fig. 50, *l*). The other point type with predominantly a late distribution is that with ear-like barbs and a concave base (category *p*). This type is probably of Reserve Phase age. A similar point was recovered from Wet Leggett Pueblo, a Reserve Phase Pueblo (Martin and Rinaldo, 1950b, Fig. 184, *n*). The other projectile point types were fairly evenly distributed through the various levels of the caves so that they could not be separated out as having an early or a late distribution.

Drills occurred in all levels of the two caves, although with less frequency than other chipped tools. None were found actually hafted, or with bindings, as were the projectile points. More drills were recovered from the lower levels than the later levels, probably because a greater number of lower levels were excavated. There is an insufficient number of specimens in any one class to indicate conclusively which might be the older. However, of the eight plain shafted specimens recovered, six occurred in the lower levels. This would agree with the evidence from Ventana Cave (Haury, 1950, p. 303) and that from the Playa Complex (Rogers, 1939, pp. 33–34, 52). An unusual form in the collections is the drill with wing-like extensions above the base (category *c*-3). Only two were found, both in Pre-Pottery levels. This form has a very sporadic distribution. It occurred in the Amargosa I Complex (Rogers, 1939, p. 63, Pl. 17), at Ventana Cave (Haury, 1950, Fig. 67, *l*), and at Pecos (Kidder, 1932, p. 28, Fig. 12, *e*). It also occurs in the Mississippi Valley.

Scrapers were one of the most numerous categories of stone artifacts. Although they were fairly evenly distributed through the various levels of the caves, there were a few more in Pre-Pottery levels than in the levels of any other one period. Certain types of scrapers, nevertheless, had a limited distribution within the cave; for example, serrate scrapers were recovered mostly from the earlier levels, and most of the ovoid end scrapers also came from earlier levels. Biface scrapers were distributed through all the levels of

Tularosa Cave but were most numerous in Georgetown Phase levels of that cave and the Pre-Pottery levels of Cordova Cave. Hollow-edged scrapers were most frequent in the Pre-Pottery levels of Cordova Cave.

The serrate or sinuous-edged scraper is one of several distinctive types found in the caves. It is reported from the SU Site (Martin, 1943, p. 212, Fig. 76, *d*) and from the Chiricahua stage of the Cochise Culture (Sayles and Antevs, 1941, Pl. X, *h*). End scrapers are another distinctive type, but these have a wider distribution. They have been reported from the Pine Lawn Valley (Martin, 1943, p. 212; Martin, Rinaldo, and Antevs, 1949, p. 172, Fig. 66, *a*). This form is also recorded by Roberts (1936, p. 23), Amsden (1937, p. 63), and Haury (1950, p. 227). These are of the keeled type and some are a combination end and side scraper.

It is possible that the implements termed "saws" here are the same type of implements that Haury (1940, p. 106) called small scrapers or knives with a single serrate edge, from Forestdale. Most of the saws came from the middle zone in the pottery midden in the caves with some tendency to occur in the later levels rather than in the earlier (none occurred earlier than San Francisco Phase levels). Similar implements have been recovered from Reserve Phase sites (Martin and Rinaldo, 1950b, p. 484) and others are illustrated by Hough (1914, Figs. 30–33) from neighboring localities.

The objects termed atlatl charm stones were found only in the lower levels. One of these has a trace of the binding marks on it, and all are similar to atlatl stones reported by Kidder and Guernsey (1919, p. 180; 1921, p. 87) and Guernsey (1931, p. 72). All atlatls from Tularosa Cave were fragmentary and broken off at the point where one would expect to find such objects tied. If one may assume that these objects are atlatl charm stones they add weight to the theory that the atlatl continued in use during the San Francisco Phase but declined in popularity later. There is negative evidence of this in the number of arrow shaft fragments found. The number of these fragments in the levels where atlatl stones, atlatl fragments, and atlatl main shaft fragments were found, is small and increases sharply in the levels later than the San Francisco Phase levels in which these objects are absent (see Chapter VII). However, the presence of atlatl dart foreshafts in the later levels indicates that the atlatl continued in use during the later occupancy of the caves. Haury reports a similar atlatl stone from Mogollon Village (1936a, p. 38).

Glycymeris shell bracelets are very common in the Mogollon and Hohokam ruins of the Southwest. They have been reported from the Pine Lawn Valley (Martin, 1940, p. 68; Martin and Rinaldo, 1950a, p. 348; 1950b, p. 492), Mogollon Village (Haury, 1936a, p. 46), Harris Village (op. cit., p. 78), Cameron Creek (Bradfield, 1931, p. 58), the Swarts Ruin (Cosgrove, 1932, pp. 65–66), and Snaketown (Gladwin and others, 1937, p. 142). They are relatively scarce in the sites farther north, particularly in the San Juan District (Tower, 1945, p. 29).

Most of the awls are not particularly distinctive in type or distribution. The shorter bone awls were found in the Georgetown Period levels. A few of these are definitely stubby (about 5 cm. long), like Basketmaker awls. However, most of the awls average 9 cm. in length and many from the earlier levels are even longer. Three of the awls have side notches, which are a characteristic feature of many awls from the Mogollon area (Martin, 1943, p. 226; Haury, 1936a, pp. 48, 110). This trait is rare or lacking in the northern sites, although it occurs in the pit-house horizon at Kiatuthlanna (Roberts, 1931, Pl. 25, *a*).

Notched ribs were found in the earlier levels of Cordova Cave. This corresponds roughly to their chronological position elsewhere. They have been reported from Jemez Cave (Alexander and Reiter, 1935, p. 36, Fig. 7). They also occurred in the Basketmaker II collections from the Durango Caves.

Bone tubes for use as pipe stems have been noted at the Starkweather Ruin (Nesbitt, 1938, p. 104, Pl. 45, F), the SU Site (Martin, 1943, Fig. 71), and at Kiatuthlanna (Roberts, 1931, Pl. 40, *a*). This appears to be a regular feature of the tubular or cylindrical stone pipe so common in the Mogollon area.

Bone dice or gaming pieces from Mogollon sites are of both oval and oblong form. They have been recorded from several periods in the open sites in the Pine Lawn Valley (Martin, 1940, p. 68; Martin and Rinaldo, 1950a, p. 348) and from all levels of Tularosa Cave. They also have their analogues in the wooden dice from the same cave. They occur at numerous Anasazi sites and at Forestdale (Haury, 1940, pp. 115–117). Haury has suggested (op. cit.) that the incised form is more frequent on Anasazi sites and that the plain or roughened form occurs less often from those sites. Most of the specimens from Tularosa Cave (both of bone and of wood) are oblong or rectangular in outline. On the other hand the Anasazi specimens tend to be elliptical, oval, or circular in outline (Guernsey and Kidder, 1921, p. 109; Kidder and Guernsey, 1919, pp. 189–190; Morris, 1939, p. 123; Gladwin, 1945, p. 58; Brew, 1946, p. 244; Martin, 1939, p. 420; Roberts, 1930, p. 147). This characteristic admittedly is a rather subtle distinction and it may not hold, after further data have been acquired.

Sections of antler that appear to have been used as hammers or as rubbing tools were recovered from both the Pre-Pottery and late levels of Cordova Cave. Similar objects were recovered from the SU Site (Martin, 1939, p. 72, Fig. 33), Ventana Cave (Haury, 1950, p. 384, Fig. 90), and a number of late Pueblo sites such as Hawikuh and Pecos (Hodge, 1920, Pl. 26, *c, d;* Kidder, 1932, Fig. 231).

One long section of antler with a hole in one end, believed to be a wrench for use in straightening arrow or dart shafts, was recovered from the Plain Ware horizon in Cordova Cave. Although one wrench was reported from Cave DuPont (Nusbaum and others, 1922, p. 123), most of these objects have occurred in Pueblo III ruins or later ones such as Canyon Creek, Kinishba, Forestdale, and Point of Pines (Haury, 1934, p. 126; Baldwin, 1939a, pp. 319–320; Hough, 1903, p. 295; Wendorf, 1950, p. 83, Pl. 15, *f*).

The human figurines appear to have little if any diagnostic value with reference to other areas. They possess only the most general resemblance to Hohokam figurines (Gladwin and others, 1937, pp. 233–242), or Basketmaker figurines (Guernsey, 1931, Pl. 51), with which they are approximately contemporaneous. It seems significant that all the specimens from the sites in the Pine Lawn Valley (Martin, 1943, p. 232; Martin and Rinaldo, 1950a, p. 352) occur early in the pottery-making era. There is some resemblance in the forked lower torso fragments to the peg-like limb fragments from Ventana Cave (Haury, 1950, p. 360, Fig. 84, *g*) and Forestdale (Haury, 1940, p. 117, Fig. 42).

On the other hand the animal effigy figurines that occurred in the Georgetown and San Francisco Phase levels in the cave had their analogues in the Reserve Phase open sites (Martin, Rinaldo, and Antevs, 1949, p. 178; Martin and Rinaldo, 1950b, p. 494; Nesbitt, 1938, Pl. 42). They also resemble the animal effigy figurines from Pecos (Kidder, 1932, pp. 125–130) and the stone animal effigy figurines to be found on the modern Hopi altars (Chicago Natural History Museum collection) and the early periods of the Hohokam at Snaketown (Gladwin and others, 1937).

The so-called cornucopia fragments were found in San Francisco Phase and later levels. They resemble objects from the Harris and

Mogollon villages (Haury, 1936a, pp. 28, 68, 103, Pls. XI, *d*, XXX, *f, g*). In form and decoration they also resemble the nipple-shaped objects of the Basketmakers (Morris, 1927, pp. 156–158; Guernsey, 1931, pp. 87–88). On the basis of this evidence it would seem that the latest cave cornucopia, which occurred in San Francisco-through-Tularosa mixed levels, belongs with the San Francisco Phase assemblage like the others.

A characteristic trait of many early Mogollon sites is the crude miniature ladle with rod-like handle. Although these ladles occur only in the mixed levels of the cave, it seems probable that they also are from the earlier assemblages represented from the mixed levels, because they occurred in the earlier open sites in the Pine Lawn Valley (Martin, 1940, Fig. 34; Martin and Rinaldo, 1947, p. 352; 1950a, p. 352), at the Mogollon Village (Haury, 1936a, p. 28), in the Forestdale Branch (Haury, 1940, Fig. 26), and in the San Simon Branch (Sayles, 1945, Pl. XVII, *e–i*).

The discovery of several modeled spindle whorls in the earlier levels of Tularosa Cave is at variance with their temporal distribution elsewhere. Their spatial distribution is primarily to the south (Di Peso, 1951, p. 107). They are reported from Los Muertos (Haury 1945a, pp. 116–119, Figs. 71–72), Snaketown (Gladwin and others, 1937, p. 245), Elden Pueblo (Fewkes, 1927, p. 213), Winona and Ridge Ruin (McGregor, 1941a, pp. 74–76), and Ventana Cave (Haury, 1950, pp. 359–360, Fig. 84, *a, b*).

The stone and bone artifacts from the caves present a picture of a conservative tool tradition that changed relatively little over the years during which the caves were occupied. This tradition developed from a base that was essentially Chiricahua in character and in its later growth remained characteristically Mogollon.

Description

Manos[1]

(Figures 31, 32)

Manos with single grinding surfaces:

(a) Oval in outline, surfaces parallel, grinding surface convex (Fig. 32, *c*). 7

Occurrence by phases, Cordova Cave:
Pre-Pottery, 3
Late, 4
Length: 11.2–21.1 cm.; average, 14.3 cm.
Width: 7.2–12.2 cm.; average, 9.2 cm.
Thickness: 4.0–9.0 cm.; average, 6.4 cm.
Materials: Rhyolite, trachyte

(b) Oval in outline, surfaces parallel, grinding surface slightly convex (Fig. 32, *a*) 6

Occurrence by phases, Cordova Cave:
Pre-Pottery, 2
Plain Ware, 1
Late, 3
Length: 10.4, 13.3, 9.8 cm., remainder fragmentary
Width: 8.8, 9.0, 7.4, 7.6, 10.5, 8.5 cm.
Thickness: 3.4, 5.0, 4.5, 4.5, 6.4, 5.0 cm.
Materials: Rhyolite, trachyte

(c) Oval in outline, surfaces parallel, grinding surface flat (Fig. 31, *c*, *d*). 12

Occurrence by phases, Tularosa Cave:
Pre-Pottery, 5
Pine Lawn, 1
Occurrence by phases, Cordova Cave:
Pre-Pottery, 1
Plain Ware, 4
Late, 1
Length: 10.3–22.3 cm.; average, 15.0 cm.
Width: 5.7–11.6 cm.; average, 9.2 cm.
Thickness: 3.0–6.6 cm.; average, 4.5 cm.
Material: Basalt

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[1] Where materials are not reported specimens were left in the field. All identifications of materials were made at the Museum on type specimens.

Manos—*continued*

(Figures 31, 32)

(d) Round in outline, surfaces parallel, grinding surface flat, upper surface rough 1

Occurrence by phases, Cordova Cave:
Late, 1
Length, 15.2 cm.; width, 12.3 cm.; thickness, 3.2 cm.

(e) Fragments with rounded edges and single flat grinding surfaces 6

Occurrence by phases, Tularosa Cave:
Pre-Pottery, 1
San Francisco, 2
San Francisco-through-Tularosa, 2
Reserve-through-Tularosa, 1
Length: All fragments
Width: 4.1, 4.9, 6.9, 6.7, fragment, 7.6 cm.
Thickness: 2.7, 2.6, 4.1, 4.5, 3.1, 2.8 cm.
Materials: Rhyolite, basalt

(f) Rectangular in outline, surfaces parallel, grinding surface slightly convex 4

Occurrence by phases, Tularosa Cave:
San Francisco, 1
San Francisco-through-Tularosa, 2
Occurrence by phases, Cordova Cave:
Plain Ware, 1
Length: 13.3 cm., remainder fragments
Width: 9.7, 9.3, 9.6, 9.0 cm.
Thickness: 4.6, 2.2, 4.0, 5.1 cm.

(g) Rectangular in outline, surfaces parallel, grinding surface flat (Fig. 31, *a*) 14

Occurrence by phases, Tularosa Cave:
San Francisco, 1
San Francisco-through-Tularosa, 2
Occurrence by phases, Cordova Cave:
Pre-Pottery, 2
Plain Ware, 1
Late, 8
Length: 14.6–15.2 cm.; average, 14.8 cm.
Width: 6.4–10.9 cm.; average, 8.4 cm.
Thickness: 2.2–6.8 cm.; average, 4.1 cm.

Manos—*continued*

(Figures 31, 32)

Manos with two grinding surfaces:

(a) Disk type; roughly round in outline, surfaces parallel, convex........ 3
  Occurrence by phases, Tularosa Cave:
    Pre-Pottery, 1
    Georgetown, 1
  Occurrence by phases, Cordova Cave:
    Pre-Pottery, 1
  Diameter: 10.7, 9.3, 10.7 cm.; thickness, 4.8, 4.3, 3.9 cm.

(b) Disk type; roughly round in outline, surfaces parallel, slightly convex. 2
  Occurrence by phases, Tularosa Cave:
    San Francisco, 1
  Occurrence by phases, Cordova Cave:
    Late, 1
  Diameter, 10.8 cm., fragments; thickness, 4.3, 2.2 cm.

(c) Roughly round in outline, with one flat, one convex grinding surface. 3
  Occurrence by phases, Tularosa Cave:
    Pre-Pottery, 2
  Occurrence by phases, Cordova Cave:
    Late, 1
  Diameter, 9.0, 9.6 cm., fragments; thickness, 4.4, 4.4, 2.4 cm.

(d) Roughly round in outline, surfaces parallel, flat.................... 8
  Occurrence by phases, Tularosa Cave:
    Pine Lawn, 1
    Georgetown, 2
    San Francisco, 1
    San Francisco-through-Tularosa, 1
    Reserve-through-Tularosa, 1
  Occurrence by phases, Cordova Cave:
    Plain Ware, 1
    Late, 1
  Diameter: 8.5–11.7 cm.; average, 9.9 cm.
  Thickness: 1.9–4.5 cm.; average, 3.1 cm.
  Materials: Limestone, basalt, rhyolite, scoria

Manos—*continued*

(Figures 31, 32)

(e) Rectangular with rounded ends in outline, surfaces parallel, slightly convex (Fig. 32, *b*, *d*) 3

Occurrence by phases, Cordova Cave:
Plain Ware, 2
Late, 1
Length: 11.6, 13.1, 13.0 cm.
Width: 8.5, 9.1, 9.1 cm.
Thickness: 3.3, 3.3, 3.2 cm.
Material: Trachyte

(f) Rectangular in outline, surfaces parallel, flat 4

Occurrence by phases, Tularosa Cave:
San Francisco, 2
Reserve-through-Tularosa, 2
Length: 16.5 cm., remainder fragmentary
Width: 8.9, 4.4, 10.0, 8.7 cm.
Thickness: 4.2, 1.8, 2.9, 2.9 cm.
Materials: Sandstone, scoria

(g) Roughly rectangular in outline, roughly triangular in cross section, one grinding surface flat, the other beveled in a double plane with a longitudinal ridge between (Fig. 31, *b*) 14

Occurrence by phases, Tularosa Cave:
San Francisco, 5
San Francisco-through-Tularosa, 5
Reserve-through-Tularosa, 4
Length: 11.8–22.0 cm.; average, 15.4 cm.
Width: 5.9–10.1 cm.; average, 8.3 cm.
Thickness: 1.9–3.8 cm.; average, 2.6 cm.
Materials: Rhyolite, sandstone

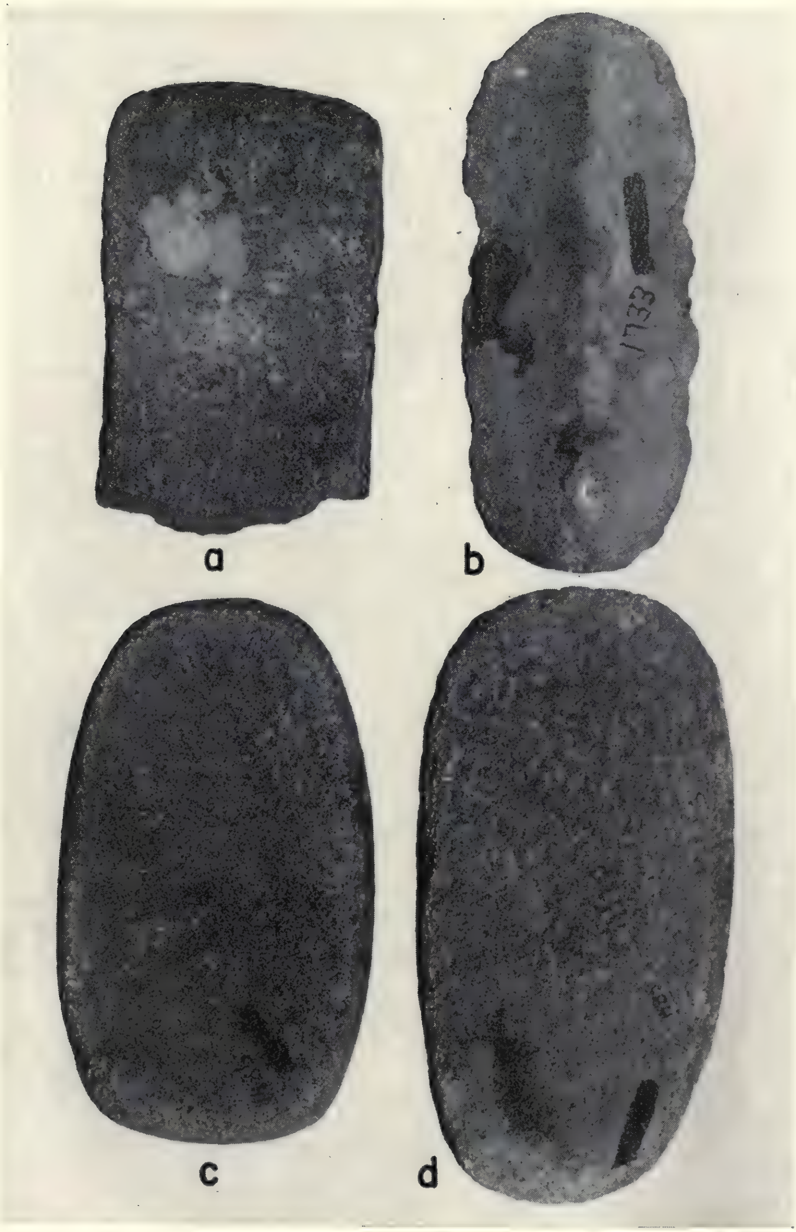


FIG. 31. Rectangular, beveled, and oval manos. Length of *d*, 22.3 cm.

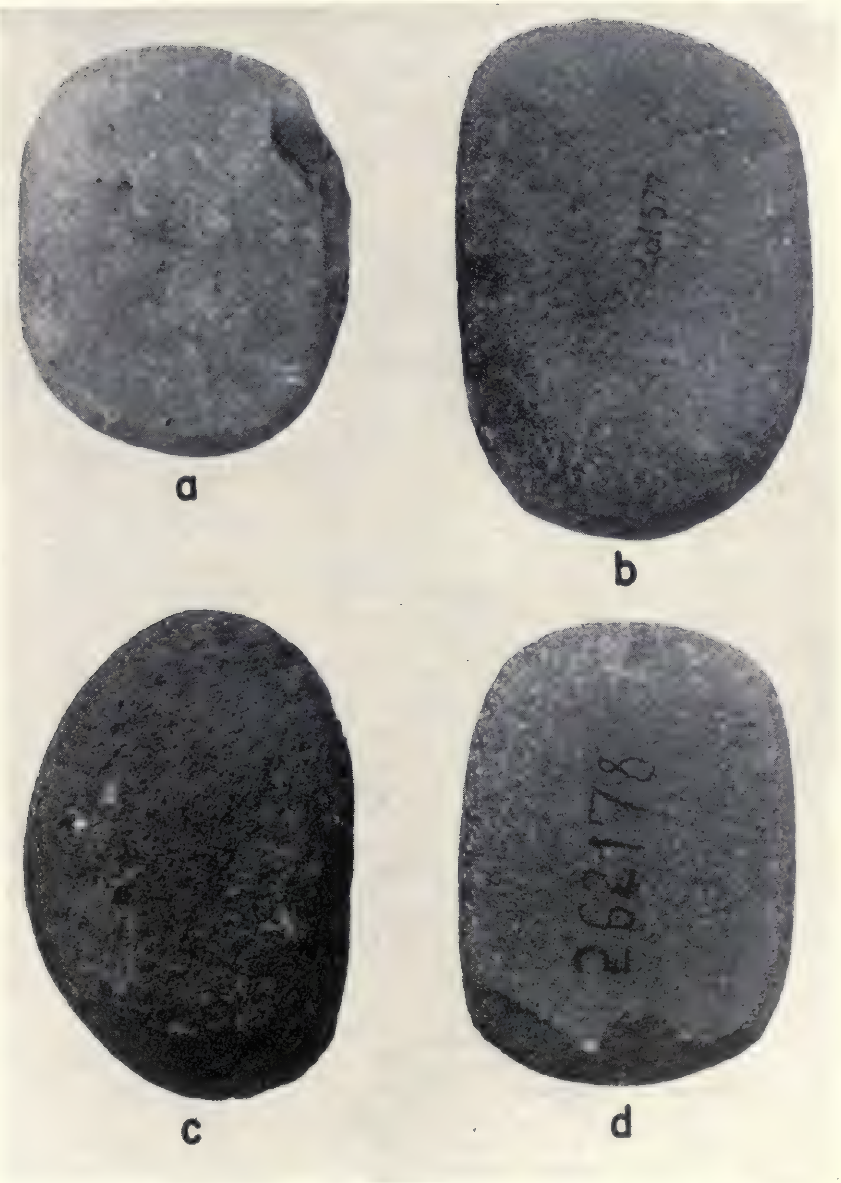


FIG. 32. Oval and rectangular manos. Length of *d*, 11.6 cm.

Rubbing Stones

(Figures 33, 34)

Rubbing stones with single rubbing surfaces:

(a) Oval in outline, surfaces parallel, rubbing surface convex, smooth (Fig. 33, *e*, *f*) 5

Occurrence by phases, Cordova Cave:
Pre-Pottery, 2
Plain Ware, 1
Late, 2

Length: 8.1, 8.0, 8.3 cm., remainder fragmentary
Width: 6.7, 6.1, 3.4, 5.6, 6.3 cm.
Thickness: 4.0, 2.8, 1.3, 2.0, 3.4 cm.
Material: Trachyte

(b) Oval in outline, surfaces parallel, rubbing surface slightly convex (Figs. 33, *d*, 34, *f*) 5

Occurrence by phases, Tularosa Cave:
Pre-Pottery, 1
San Francisco, 1
San Francisco-through-Tularosa, 1
Reserve-through-Tularosa, 1

Occurrence by phases, Cordova Cave:
Late, 1

Length: 8.0, 8.1, 7.9, 9.2, 9.7 cm.
Width: 6.1, 7.9, 6.6, 8.8, 8.2 cm.
Thickness: 2.3, 3.1, 3.3, 6.4, 4.7 cm.
Material: Basalt, limestone

(c) Oval in outline, surfaces parallel, rubbing surface flat (Fig. 33, *c*) .. 2

Occurrence by phases, Cordova Cave:
Plain Ware, 1
Late, 1

Length: 6.0, 7.1 cm.; width, 4.2, 5.3 cm.; thickness, 2.7, 2.3 cm.
Material: Scoria

(d) Irregular in outline, surfaces parallel, rubbing surface flat (Figs. 33, *a*, 34, *b*, *c*, *e*) 41

Occurrence by phases, Tularosa Cave:
Pre-Pottery, 2
Pine Lawn, 4
Georgetown, 11
San Francisco, 7
San Francisco-through-Tularosa, 11
Reserve-through-Tularosa, 5

Occurrence by phases, Cordova Cave
Late, 1

Length: 6.8–10.5 cm.; average, 8.5 cm.
Width: 2.9–8.4 cm.; average, 5.6 cm.
Thickness: 1.5–4.5 cm.; average, 2.4 cm.
Materials: Trachyte, rhyolite

Rubbing Stones—*continued*

(Figures 33, 34)

Rubbing stones with two rubbing surfaces:

(a) Oval in outline, surfaces parallel, flat 2

Occurrence by phases, Cordova Cave:
Pre-Pottery, 1
Late, 1

Length, 6.2, 5.4 cm.; width, fragment, 5.0 cm.; thickness, 2.5, 2.4 cm.

(b) Roughly round in outline, wedge-shaped in cross section, one rubbing surface flat, the other slightly convex (Fig. 33, *b*) 1

Occurrence by phases, Cordova Cave:
Late, 1

Length, 9.7 cm.; width, 8.2 cm.; thickness, 4.5 cm.

(c) Roughly rectangular in outline, surfaces parallel; smooth, flat, rubbing surfaces (Fig. 34, *a*, *d*) 6

Occurrence by phases, Tularosa Cave:
Georgetown, 2
San Francisco-through-Tularosa, 4

Length: 10.0, 9.2, 8.3, 9.5, 7.6, 7.2 cm.
Width: 5.3, 6.2, 5.3, 6.5, 4.9, 6.4 cm.
Thickness: 2.9, 1.3, 3.1, 2.1, 1.8, 2.9 cm.
Materials: Basalt, rhyolite, limestone

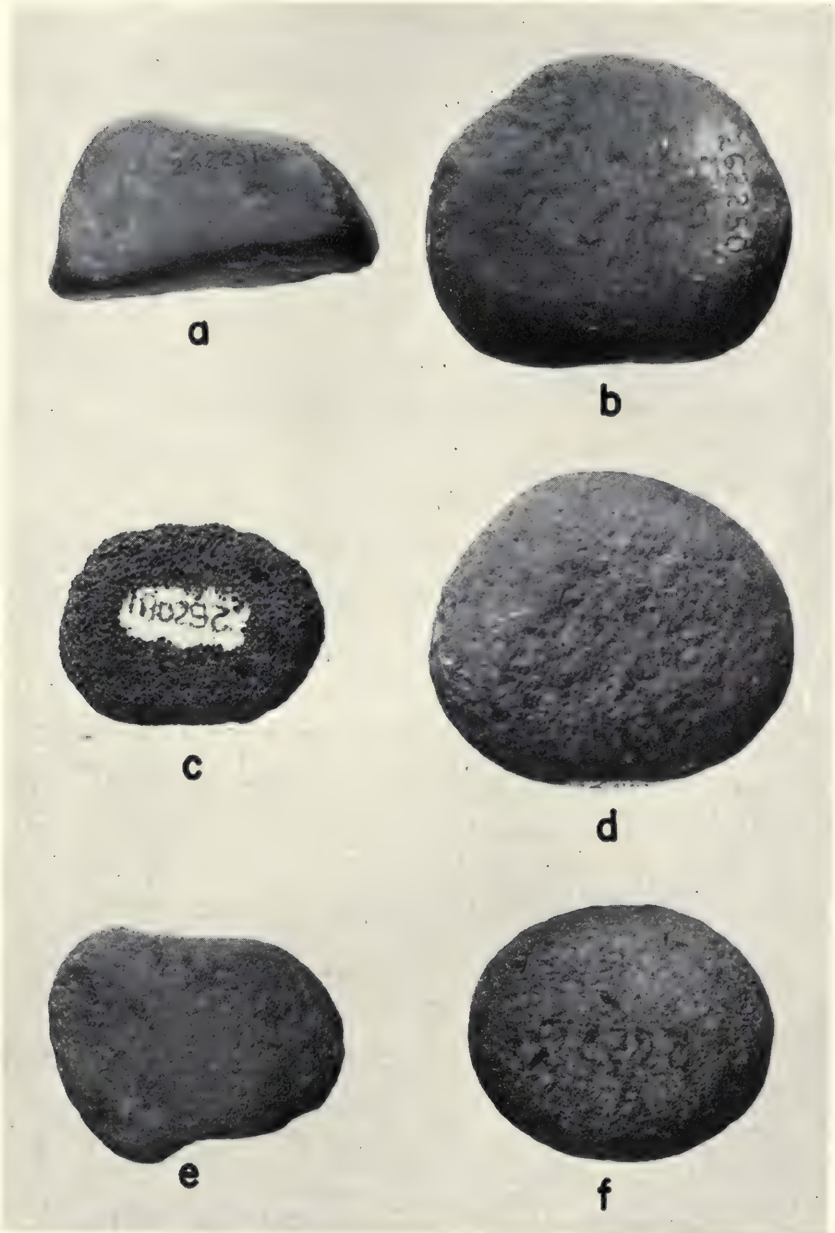


FIG. 33. Irregularly shaped and oval rubbing stones. Length of *f*, 8.1 cm.

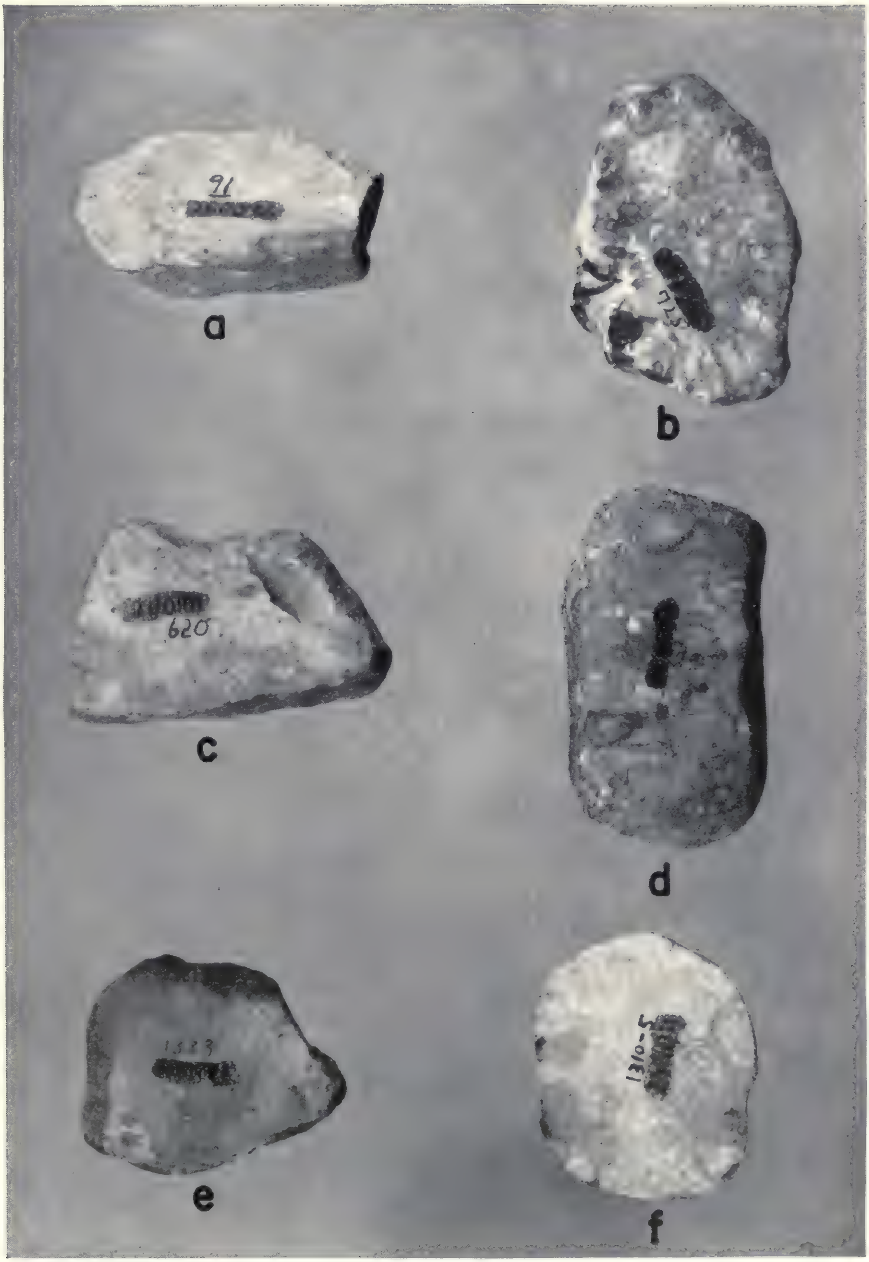

91
a
725
b
620
c
d
1333
e
1310-5
f

FIG. 34. Rubbing stones. Length of *f*, 7.6 cm.

Polishing Stones

(Figure 35)

Oval or roundish in outline with one or more smooth, flat, polishing surfaces (Fig. 35) 20

Occurrence by phases, Tularosa Cave:
  Pre-Pottery, 2
  Pine Lawn, 1
  Georgetown, 5
  San Francisco, 3
  San Francisco-through-Tularosa, 2
Occurrence by phases, Cordova Cave:
  Plain Ware, 3
  Late, 4
Length: 2.6–7.3 cm.; average, 4.6 cm.
Width: 2.1–5.3 cm.; average, 3.4 cm.
Thickness: 1.0–3.6 cm.; average, 2.1 cm.
Materials: Quartz, basalt, rhyolite, limestone

Pestles

(Not illustrated)

(a) Multifaced type; angular or roughly round pebbles with some pecked flat surfaces and round battered ends 3

  Occurrence by phases, Tularosa Cave:
    Pine Lawn, 1
    San Francisco, 1
    Reserve-through-Tularosa, 1
  Length: 8.5, 10.7, 9.2 cm.
  Width: 6.6, 7.2, 7.5 cm.
  Thickness: 5.9, 4.6, 6.2 cm.

(b) Angular type; long angular stone unaltered except for one end, which is round, battered, and pecked 1

  Occurrence by phases, Tularosa Cave:
    San Francisco, 1
  Length, 11.6 cm.; width, 7.0 cm.; thickness, 5.7 cm.

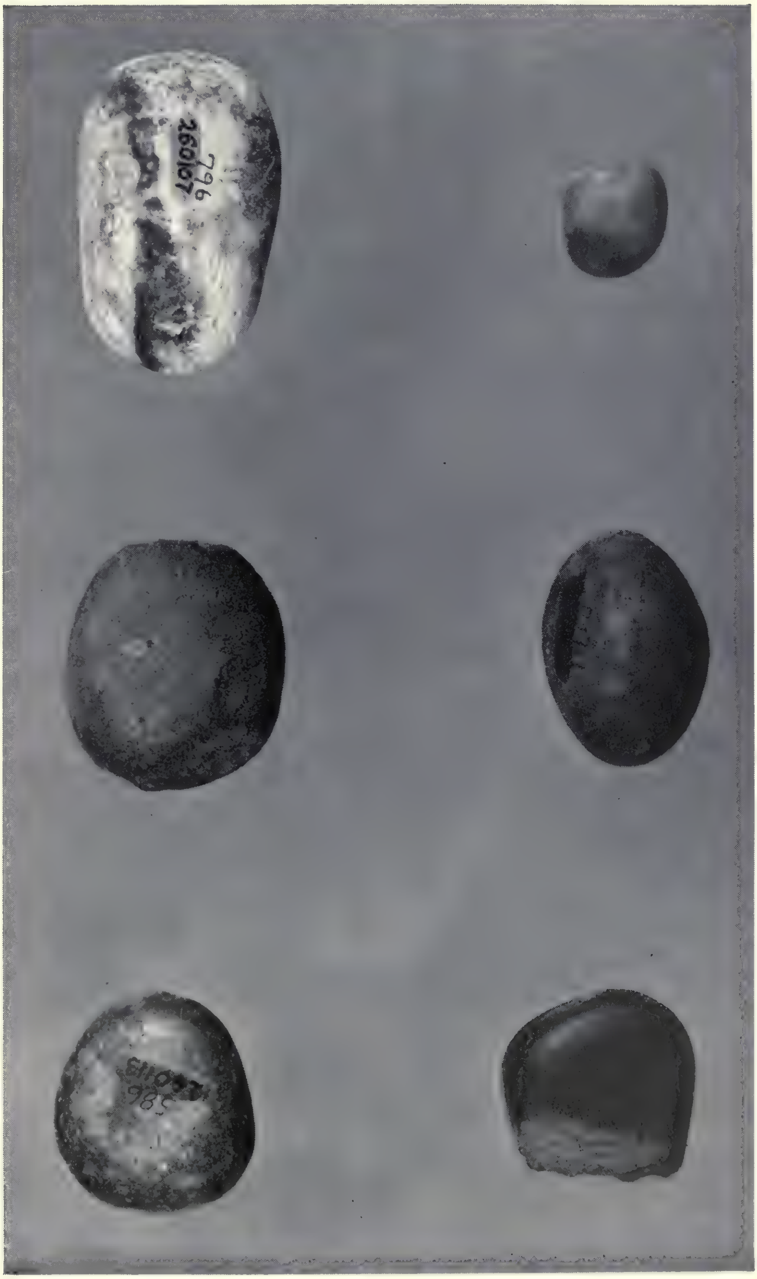


FIG. 35. Polishing stones. Length of right specimen (bottom row), 4.7 cm.

Metates

(Figures 36–38)

(a) Slab type, large slab, generally rectangular or oval in outline with flat or slightly concave upper surface; bottom and sides of slab unworked; grinding surface usually smooth, sometimes pecked (Fig. 36) 8

Occurrence by phases, Tularosa Cave:
  Pine Lawn, 2
  San Francisco, 2
  Unplaced, 1
Occurrence by phases, Cordova Cave:
  Pre-Pottery, 2
  Late, 1
Length: 27.0–50.7 cm.; average, 35.9 cm.
Width: 19.0–35.0 cm.; average, 23.1 cm.
Thickness: 3.0–12.0 cm.; average, 7.6 cm.

(b) Basin type with secondary depression (see *Boulder Mortar*, p. 141) 1

Occurrence by phases, Tularosa Cave:
  Georgetown, 1

(c) Basin type, unshaped blocks of stone generally oval to broad triangular in outline with oval grinding surface somewhat basin-shaped and frequently extending to one edge of stone (Figs. 37, 38) 19

Occurrence by phases, Tularosa Cave:
  Pre-Pottery, 3
  Pine Lawn, 2
  Georgetown, 7
  San Francisco, 3
  Unplaced, 1
Occurrence by phases, Cordova Cave:
  Pre-Pottery, 3
Length: 22.0–60.0 cm.; average, 39.2 cm.
Width: 18.0–40.0 cm.; average, 29.9 cm.
Thickness: 3.0–16.0 cm.; average, 10.9 cm.
Basin dimensions:
  Length: 20.0–30.0 cm.; average, 24.0 cm.
  Width: 16.0–26.0 cm.; average, 22.0 cm.
  Depth: 1.0–5.0 cm.; average, 2.4 cm.

(d) Trough type, roughly rectangular to boat-shaped blocks of stone with trough-shaped grinding surface open at one end only; shelf at closed end present on four specimens 8

Occurrence by phases, Tularosa Cave:
  Pine Lawn, 1
  Georgetown, 1
  San Francisco, 3
Occurrence by phases, Cordova Cave:
  Plain Ware, 1
  Late, 2
Length: 34.0–46.0 cm.; average, 40.0 cm.
Width: 20.0–32.0 cm.; average, 27.0 cm.
Thickness: 6.0–20.0 cm.; average, 11.8 cm.
Dimensions of trough:
  Length: 29.0 cm., remainder fragmentary
  Width: 17.0–24.0 cm.; average, 21.0 cm.
  Depth: 1.5–5.5 cm.; average, 3.2 cm.

(e) Fragments of metate grinding surfaces 7

Occurrence by phases, Cordova Cave:
  Pre-Pottery, 2
  Late, 5
Length and width: All fragmentary
Thickness: 1.8–7.0 cm.; average, 4.2 cm.

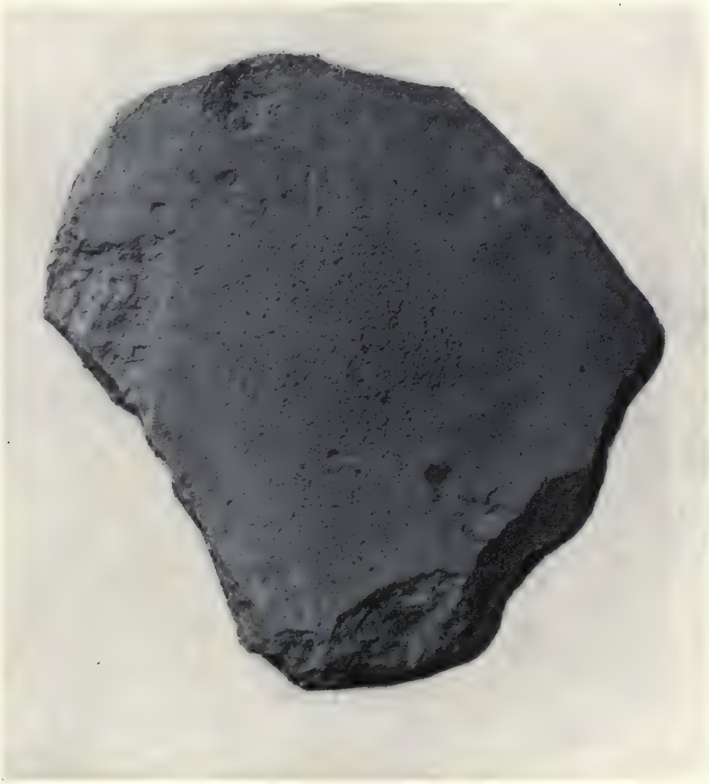


FIG. 36. Slab type metate, Cordova Cave. Length, 30.1 cm.

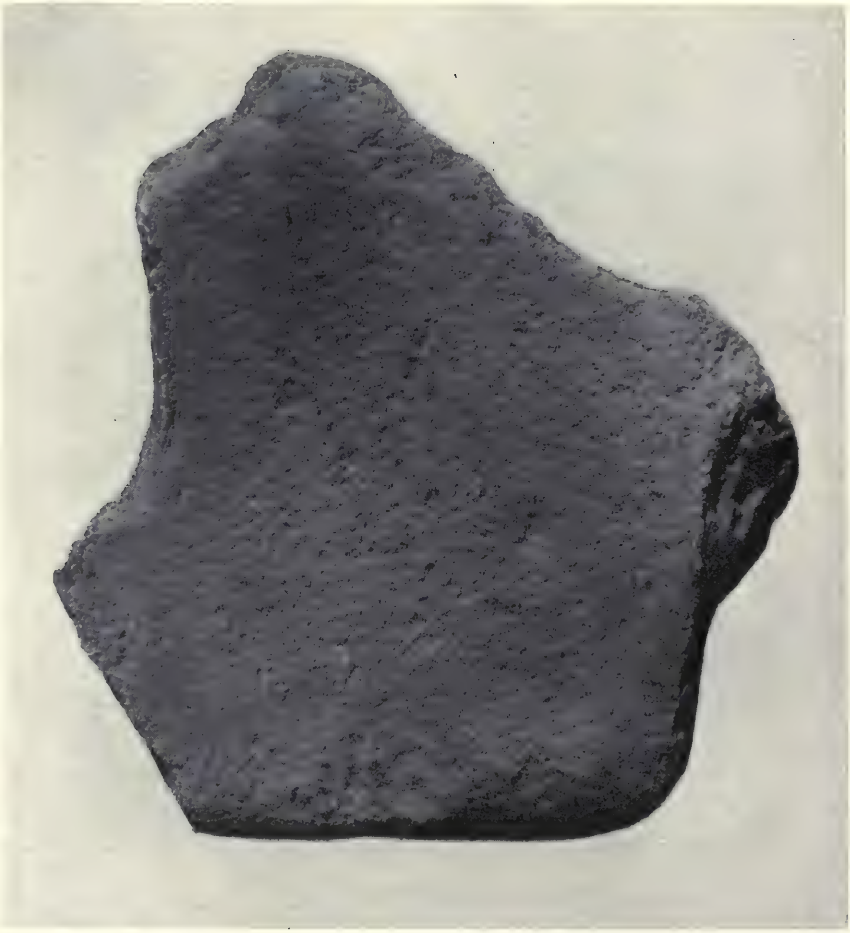


FIG. 37. Shallow, basin type metate, Tularosa Cave. Length, 32.0 cm.

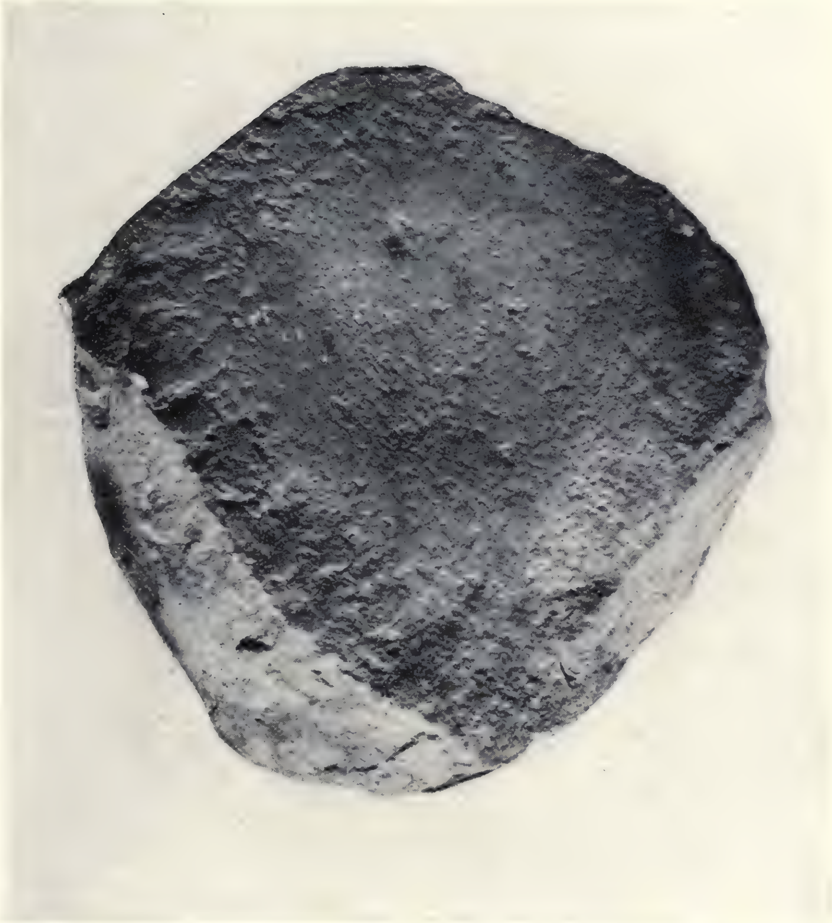


FIG. 38. Basin type metate, Tularosa Cave. Length, 33.0 cm.

Small, Metate-like Grinding Stones

(Figure 39)

Small slabs of stone, asymmetrical in outline, with single, slightly concave grinding surface	5

Occurrence by phases, Tularosa Cave:
- Pre-Pottery, 1
- Georgetown, 2
- San Francisco, 1
- San Francisco (cave floor), 1

Length: 20.0, 17.9, 11.7 cm., remainder fragments

Width: 15.0, 11.8, 12.4, 10.1, 12.4 cm.

Thickness: 10.0, 3.7, 3.3, 2.5, 2.5 cm.

Material: Rhyolite

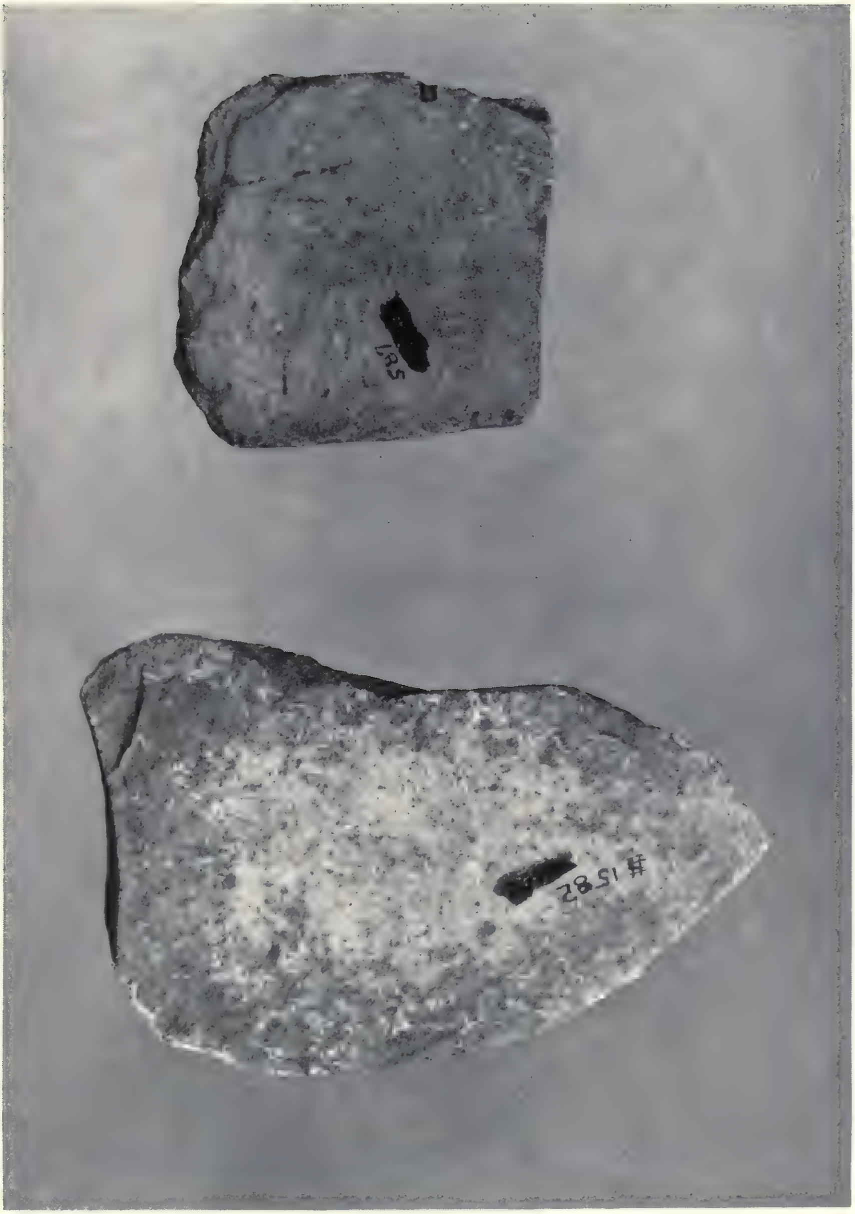


FIG. 39. Small, metate-like grinding stones. Length of bottom specimen, 17.9 cm.

Paint Grinding Stones

(Figure 40)

Small flat slabs of stone with paint remaining in limited area on one surface; some with rough grinding surfaces, others with smooth grinding surfaces; five used for red paint, two for green paint.............................. 7

Occurrence by phases, Tularosa Cave:
- Pre-Pottery, 1
- San Francisco, 2
- San Francisco-through-Tularosa, 4

Length: 12.3, 14.5, 10.1, 8.1, 14.7, 10.4, 12.8 cm.

Width: 11.2, 9.3, 6.9, 4.4, 11.1, 9.8, 11.2 cm.

Thickness: 1.2, 2.0, 1.7, 2.1, 2.2, 2.4, 2.4 cm.

Material: Rhyolite

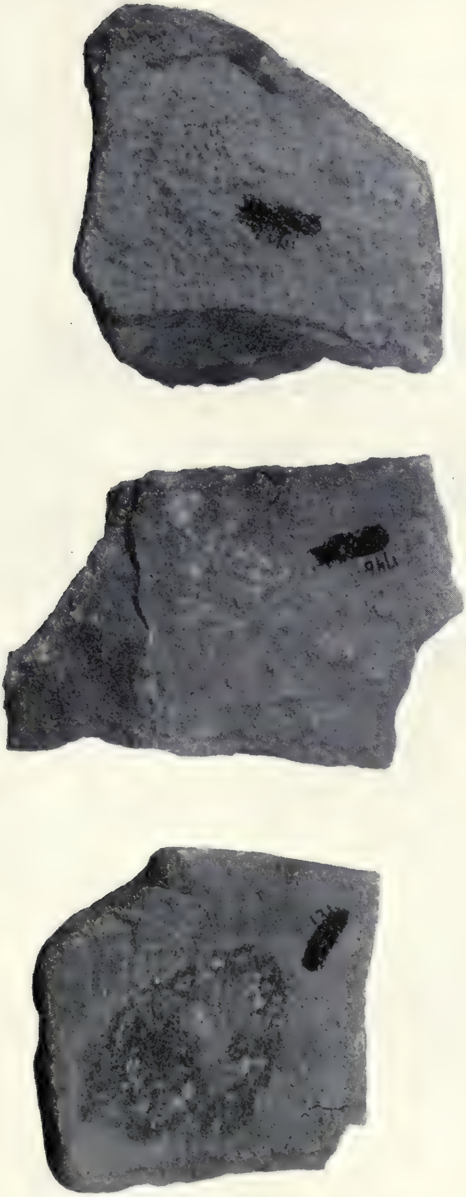


FIG. 40. Paint grinding stones. Length of bottom specimen, 10.4 cm.

Mortar

(Figure 41)

Boulder mortar type, unshaped block of stone with grinding surface worn to slight concavity; small round cup-shaped hole in center of basin; bottom and sides of boulder unaltered	1

Occurrence by phases, Tularosa Cave:
Georgetown, 1

Length, 46.0 cm.; width, 34.0 cm.; thickness, 11.0 cm.

Dimensions of cup-shaped depression:
Length, 16.0 cm.; width, 15.0 cm.; depth, 6.5 cm.

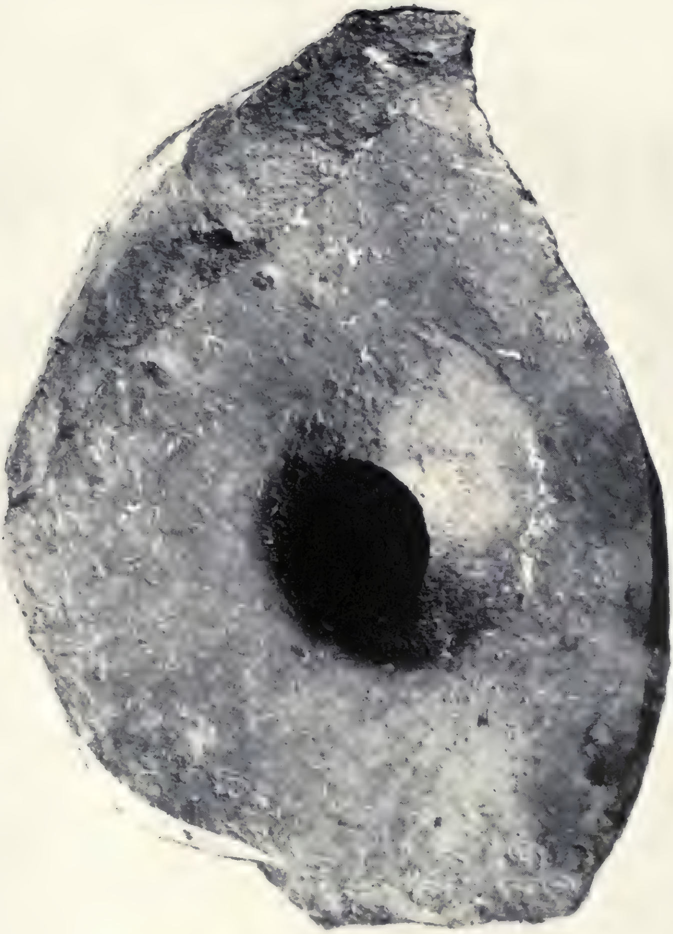


FIG. 41. Boulder mortar. Length, 46.0 cm.

Worked Slabs

(Not illustrated)

Thin flat slabs with smooth parallel surfaces; shape irregular in outline..... 3

Occurrence by phases, Tularosa Cave:
  San Francisco-through-Tularosa, 1
  Reserve-through-Tularosa, 1

Occurrence by phases, Cordova Cave:
  Late, 1

Length, 24.3 cm., others fragmentary; width, 13.4, 13.7 cm., other fragmentary; thickness, 1.2, 1.8, 3.4 cm.

Hammerstones

(Figure 42)

Battered and pitted pebbles mostly of round and angular shapes........... 37

Occurrence by phases, Tularosa Cave:
  Pre-Pottery, 1
  Pine Lawn, 2
  Georgetown, 1
  San Francisco, 1
  San Francisco-through-Tularosa, 3
  Reserve-through-Tularosa, 3

Occurrence by phases, Cordova Cave:
  Pre-Pottery, 11
  Plain Ware, 3
  Late, 12

Length: 4.3–11.6 cm.; average, 7.8 cm.

Width: 3.9–9.7 cm.; average, 6.4 cm.

Thickness: 3.6–7.2 cm.; average, 5.2 cm.

Materials: Basalt, chert

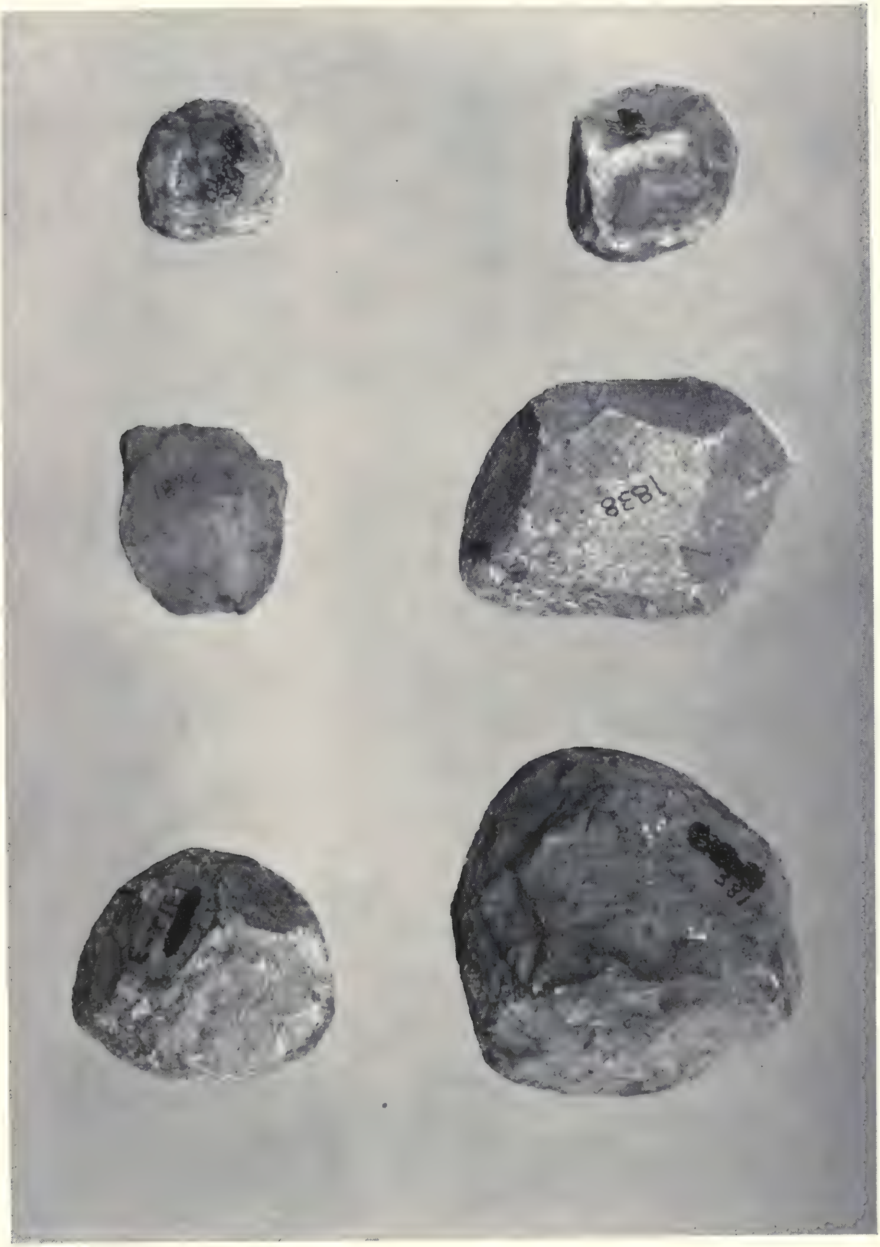


FIG. 42. Hammerstones. Length of right specimen (bottom row), 9.8 cm.

Abrading Stones

(Figure 43)

Oblong pebbles of coarse-grained stone with concave or worked surfaces that show use for grinding.. 8

Occurrence by phases, Tularosa Cave:
Pre-Pottery, 2
Georgetown, 3
San Francisco, 2

Occurrence by phases, Cordova Cave:
Plain Ware, 1

Length: 4.7–9.5 cm.; average, 7.3 cm.

Width: 3.8–7.6 cm.; average, 5.2 cm.

Thickness: 0.9–2.8 cm.; average, 1.9 cm.

Awl Sharpeners

(Figure 43)

Irregular pieces of coarse-grained stone with straight deep grooves in surfaces; grooves vary in width and depth, taper at ends, and cross................ 6

Occurrence by phases, Tularosa Cave:
Pine Lawn, 2
Georgetown, 1
San Francisco-through-Tularosa, 1
Reserve-through-Tularosa, 1
Unplaced, 1

Length: 8.9, 8.7, 7.6, 7.3, 4.6, 6.2 cm.

Width: 8.8, 5.6, 4.5, 5.1, 4.4, 3.0 cm.

Thickness: 2.6, 3.2, 4.2, 2.6, 3.1, 2.4 cm.

Material: Sandstone

Stone Balls

(Figure 43)

Small round objects.. 18

Occurrence by phases, Tularosa Cave:
Pre-Pottery, 8
Pine Lawn, 2
Georgetown, 4
San Francisco, 2
San Francisco-through-Tularosa, 2

Diameter: 1.7–3.4 cm.; average, 2.4 cm.

Material: Sandstone

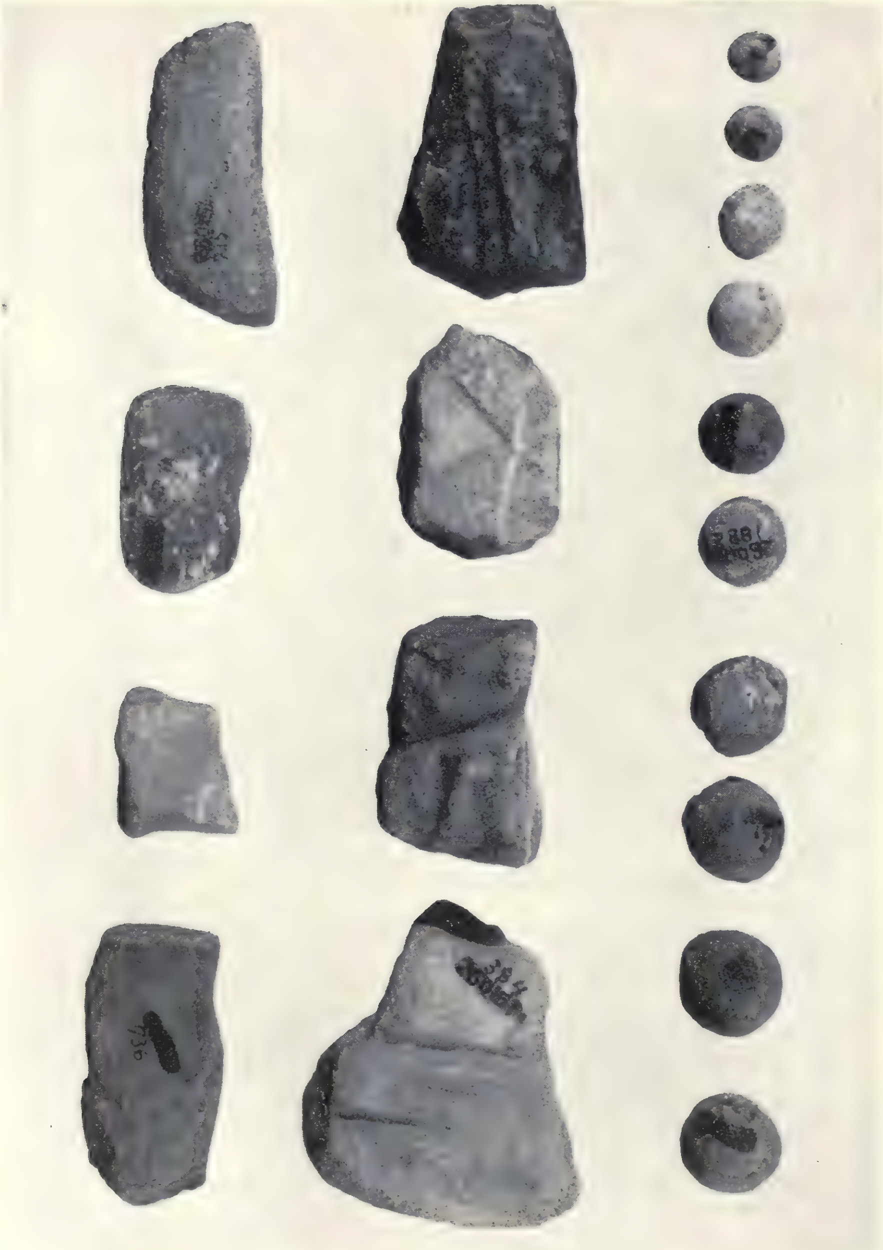


FIG. 43. Left to right: abrading stones, awl sharpeners, and stone balls. Diameter of right specimen (bottom row), 3.2 cm.

Stone Pipes

(Figure 44)

Tubular type, tapering slightly from larger bowl end to smaller stem end; central perforation through pipe is narrower about half way from bowl end to stem end; one with tubular bone stem; stripe decoration encircles stem end 3

Occurrence by phases, Tularosa Cave:
  Georgetown, 1
  San Francisco-through-Tularosa, 1

Occurrence by phases, Cordova Cave:
  Late, 1

Length: 6.6, 6.5 cm., fragment; diameter, 2.9, 3.7 cm., fragment

Material: Scoria

Foot Effigies

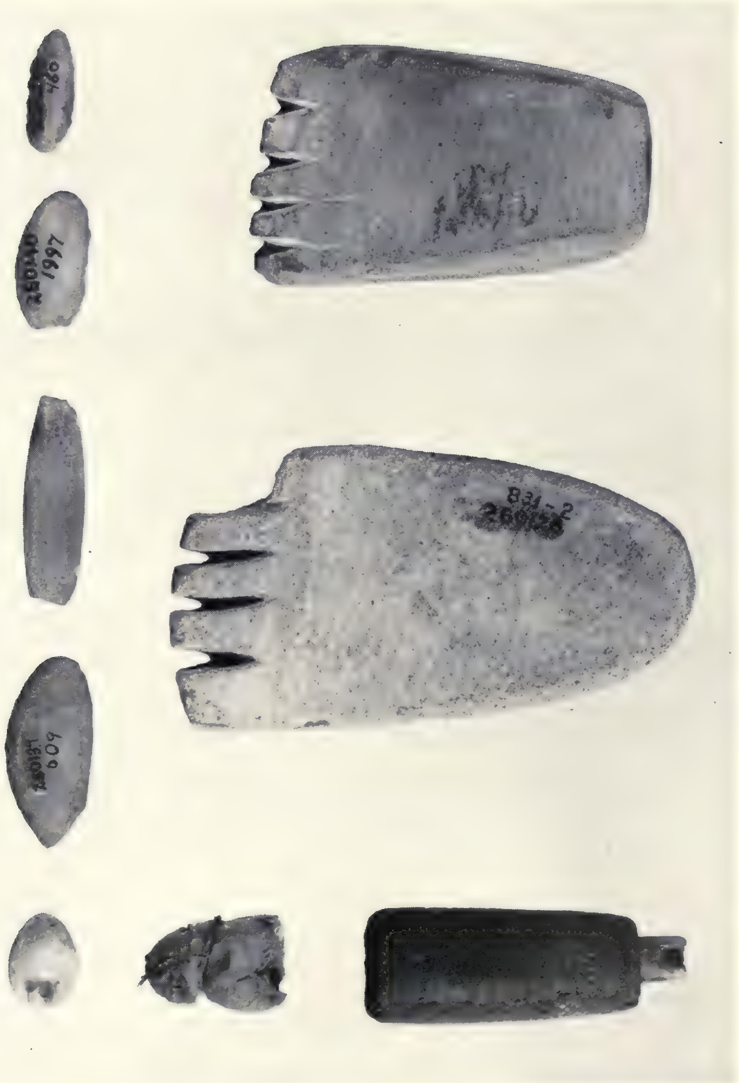
(Figure 44)

Stone blocks, smoothed and shaped to foot form, notched on one end to form five toes.. 2

Occurrence by phases, Tularosa Cave:
  San Francisco, 2

Length, 9.5, 12.9 cm.; width, 5.6, 7.1 cm.; thickness, 2.9, 1.7 cm.

Material: Sandstone


460
260140
1997
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260126
260121
609

FIG. 44. Atlatl charm stones, pendant, pipe, and foot effigies. Length of pipe, 6.6 cm.

Projectile Points and Blades

(Figures 45–51)

(a) Corner notched, concave base, expanding stem narrower than shoulder, one edge serrate, base thinned (Figs. 45, *a–d*, 46, *k*, *l*) 7

- Occurrence by phases, Tularosa Cave:
  - Pre-Pottery, 2
  - Pine Lawn, 2
  - San Francisco, cave floor, 1
- Occurrence by phases, Cordova Cave:
  - Pre-Pottery, 2
- Length: 2.1–4.3 cm.; average, 2.8 cm.
- Width: 1.6–2.6 cm.; average, 2.0 cm.
- Thickness: 0.4–0.6 cm.; average, 0.5 cm.
- Materials: Chert, fine-grained basalt

(b-1) Diagonal notched, expanding stem narrower than shoulder, base slightly convex, down-raking barbs, relatively large size (Fig. 45, *e–h*) 22

- Occurrence by phases, Tularosa Cave:
  - Pre-Pottery, 5
  - Georgetown, 2
  - San Francisco, 2
  - San Francisco-through-Tularosa, 7
  - San Francisco, cave floor, 1
  - Unplaced, 1
- Occurrence by phases, Cordova Cave:
  - Pre-Pottery, 1
  - Plain Ware, 1
  - Late, 2
- Length: 2.8–6.0 cm.; average, 4.8 cm.
- Width: 2.1–3.6 cm.; average, 2.8 cm.
- Thickness: 0.4–0.8 cm.; average, 0.5 cm.
- Materials: Chert, fine-grained basalt

(b-2) Diagonal notched, same general shape but shorter and broader proportions and more convex edges (Fig. 45, *i–l*) 67

- Occurrence by phases, Tularosa Cave:
  - Pre-Pottery, 11
  - Pine Lawn, 5
  - Georgetown, 7
  - San Francisco, 7
  - San Francisco, cave floor, 4
  - San Francisco-through-Tularosa, 6
  - Reserve-through-Tularosa, 1
- Occurrence by phases, Cordova Cave:
  - Pre-Pottery, 12
  - Plain Ware, 4
  - Late, 10
- Length: 1.9–3.9 cm.; average, 2.7 cm.
- Width: 1.4–3.1 cm.; average, 2.1 cm.
- Thickness: 0.3–0.8 cm.; average, 0.4 cm.
- Materials: Chert, obsidian, jasper, fine-grained basalt

Projectile Points and Blades—*continued*

(Figures 45–51)

(b-3) Diagonal notched, same general shape but longer and narrower proportions (Fig. 45, *m–p*) 11

Occurrence by phases, Tularosa Cave:
  Pre-Pottery, 2
  Pine Lawn, 3
  Georgetown, 4
  San Francisco, 1

Occurrence by phases, Cordova Cave:
  Pre-Pottery, 1

Length: 2.6–4.5 cm.; average, 3.5 cm.

Width: 1.8–2.3 cm.; average, 2.0 cm.

Thickness: 0.3–0.7 cm.; average, 0.4 cm.

Materials: Chert, jasper, fine-grained basalt

(b-4) Diagonal notched, same general shape but smaller and thinner with narrower stems and bases (Fig. 45, *q–t*) 23

Occurrence by phases, Tularosa Cave:
  Georgetown, 1
  San Francisco, 4
  San Francisco-through-Tularosa, 4

Occurrence by phases, Cordova Cave:
  Pre-Pottery, 4
  Plain Ware, 4
  Late, 6

Length: 2.2–3.3 cm.; average, 2.9 cm.

Width: 1.2–2.1 cm.; average, 1.6 cm.

Thickness: 0.2–0.6 cm.; average, 0.3 cm.

Materials: Obsidian, chert

(c) Deep lateral notched, straight base, expanding stem narrower than shoulder, sharp lateral barbs (Fig. 47, *a–d*) 16

Occurrence by phases, Tularosa Cave:
  Pre-Pottery, 3
  Pine Lawn, 2
  Georgetown, 2
  San Francisco, cave floor, 2
  San Francisco, 1

Occurrence by phases, Cordova Cave:
  Pre-Pottery, 3
  Late, 3

Length: 2.0–2.9 cm.; average, 2.4 cm.

Width: 1.4–2.2 cm.; average, 1.7 cm.

Thickness: 0.3–0.5 cm.; average, 0.4 cm.

Materials: Chert, jasper, obsidian, fine-grained basalt

Projectile Points and Blades—*continued*

(Figures 45–51)

(d) Small, shallow lateral notched, straight base narrower than shoulder, some with serrate edges (Figs. 47, *e–h*, 48, *a–d*) 17

Occurrence by phases, Tularosa Cave:
Pre-Pottery, 1
Pine Lawn, 2
San Francisco, 3

Occurrence by phases, Cordova Cave:
Pre-Pottery, 9
Plain Ware, 2

Length: 1.9–2.8 cm.; average, 2.4 cm.

Width: 1.0–1.9 cm.; average, 1.5 cm.

Thickness: 0.3–0.6 cm.; average, 0.4 cm.

Materials: Obsidian, fine-grained basalt

(e-1) Slender point with wide lateral notches, expanding base narrower than shoulder, base straight to slightly convex, sharp lateral barbs (Figs. 46, *h–j*, 47, *i–l*) 15

Occurrence by phases, Tularosa Cave:
Pre-Pottery, 1
Georgetown, 5
San Francisco, cave floor, 2

Occurrence by phases, Cordova Cave:
Pre-Pottery, 3
Plain Ware, 4

Length: 4.3–6.6 cm.; average, 4.6 cm.

Width: 1.6–2.9 cm.; average, 2.0 cm.

Thickness: 0.4–0.6 cm.; average, 0.5 cm.

Materials: Chert, fine-grained basalt, rhyolite

(e-2) Lateral notched, expanding base narrower than shoulder, lateral barbs, straight base, shorter, thicker and broader than e-1 (Fig. 49, *m–p*) 30

Occurrence by phases, Cordova Cave:
Pre-Pottery, 12
Plain Ware, 8
Late, 10

Length: 3.0–4.8 cm.; average, 4.0 cm.

Width: 2.0–2.8 cm.; average, 2.5 cm.

Thickness: 0.5–0.9 cm.; average, 0.6 cm.

Materials: Fine-grained basalt, chert

(e-3) Lateral notched blades, expanding base narrower than shoulder, base straight to slightly convex, large size (Fig. 49, *f*) 4

Occurrence by phases, Cordova Cave:
Pre-Pottery, 2
Late, 2

Length: All fragments over 4.0 cm.

Width: 3.4, 3.9, 3.4, 3.5 cm.

Thickness: 0.8, 0.8, 0.7, 1.0 cm.

Materials: Fine-grained basalt, chert

(Figures 45–51)

(f-1)	Lateral notched, expanding base wider than shoulder, convex or thinned base; thick, crudely flaked (Fig. 47, *m–p*)	16

Occurrence by phases, Tularosa Cave:
  Georgetown, 3
  San Francisco, cave floor, 3
  San Francisco, 2
  San Francisco-through-Tularosa, 1
Occurrence by phases, Cordova Cave:
  Plain Ware, 2
  Late, 5
Length: 3.3–5.0 cm.; average, 3.9 cm.
Width: 1.5–2.9 cm.; average, 1.9 cm.
Thickness: 0.4–1.0 cm.; average, 0.6 cm.
Materials: Fine-grained basalt, chert

(f-2) Lateral notched, expanding base wider than shoulder, small triangular points with slightly convex to convex bases 3

Occurrence by phases, Cordova Cave:
  Late, 3
Length, 2.6, 2.4, 2.0 cm.; width, 1.6, 1.5, 1.4 cm.; thickness, 0.5, 0.5, 0.4 cm.
Materials: Obsidian, chert

(g) Shallow lateral notched, convex base, convex edges (Figs. 46, *a–d*, 47, *q–t*) 35

Occurrence by phases, Tularosa Cave:
  Pre-Pottery, 3
  Pine Lawn, 5
  Georgetown, 4
  San Francisco, 9
  San Francisco-through-Tularosa, 1
Occurrence by phases, Cordova Cave:
  Pre-Pottery, 9
  Plain Ware, 2
  Late, 2
Length: 2.2–3.5 cm.; average, 2.8 cm.
Width: 1.2–2.1 cm.; average, 1.6 cm.
Thickness: 0.2–0.6 cm.; average, 0.4 cm.
Materials: Chert, fine-grained basalt, banded jasper

(h-1) Small, slightly expanding stem narrower than shoulder, lateral barbs (Fig. 50, *a–d*) 16

Occurrence by phases, Tularosa Cave:
  Pre-Pottery, 2
  Pine Lawn, 2
  Georgetown, 2
  San Francisco, 2
  San Francisco-through-Tularosa, 1
Occurrence by phases, Cordova Cave:
  Pre-Pottery, 1
  Plain Ware, 4
  Late, 2
Length: 2.2–3.5 cm.; average, 2.8 cm.
Width: 0.9–2.1 cm.; average, 1.6 cm.
Thickness: 0.3–0.6 cm.; average, 0.4 cm.
Materials: Chert, fine-grained basalt, obsidian

Projectile Points and Blades—*continued*

(Figures 45–51)

(h-2) Small, lateral notched, expanding stem narrower than shoulder, lateral barbs, broader stems (Fig. 48, *e–h*) 15

Occurrence by phases, Cordova Cave:
Pre-Pottery, 12
Plain Ware, 1
Late, 2

Length: 2.8–3.5 cm.; average, 3.1 cm.
Width: 1.5–2.1 cm.; average, 1.9 cm.
Thickness: 0.3–0.7 cm.; average, 0.5 cm.
Materials: Fine-grained basalt, chert

(i) Broad straight stem, straight base, sharp lateral barbs (Figs. 46, *e–g*, 50, *e–h*) 10

Occurrence by phases, Tularosa Cave:
Pre-Pottery, 1
Pine Lawn, 1
San Francisco, cave floor, 1
San Francisco, 2
San Francisco-through-Tularosa, 2

Occurrence by phases, Cordova Cave:
Pre-Pottery, 3

Length: 1.5–5.1 cm.; average, 3.0 cm.
Width: 1.4–3.1 cm.; average, 2.0 cm.
Thickness: 0.2–1.0 cm.; average, 0.5 cm.
Materials: Chert, fine-grained basalt

(j) Shallow lateral notched, broad expanding base as wide as shoulder, sharp lateral barbs, relatively small points (Fig. 50, *i–l*) 11

Occurrence by phases, Tularosa Cave:
Pre-Pottery, 3
Pine Lawn, 4
Georgetown, 3

Occurrence by phases, Cordova Cave:
Pre-Pottery, 1

Length: 1.7–2.5 cm.; average, 2.1 cm.
Width: 1.4–1.9 cm.; average, 1.6 cm.
Thickness: 0.2–0.4 cm.; average, 0.3 cm.
Material: Chert

(k) Oval blades with single corner notch, one edge less convex than the other (Fig. 50, *m–q*) 4

Occurrence by phases, Tularosa Cave:
Pine Lawn, 2
San Francisco, 2

Length: 2.6, 2.5, 2.3 cm., one fragment
Width: 1.8, 1.9, 1.3, 1.6 cm.
Thickness: 0.4, 0.5, 0.5, 0.3 cm.
Material: Chert

Projectile Points and Blades—*continued*

(Figures 45–51)

(l) Roughly leaf-shaped; upper portion of edges slightly convex, basal portion straight; base straight (Fig. 50, *q–t*) 7

Occurrence by phases, Tularosa Cave:
Pine Lawn, 1
Georgetown, 2

Occurrence by phases, Cordova Cave:
Pre-Pottery, 2
Plain Ware, 2

Length: 2.6–4.0 cm.; average, 3.1 cm.
Width: 1.5–2.1 cm.; average, 1.7 cm.
Thickness: 0.3–0.8 cm.; average, 0.4 cm.
Materials: Obsidian, chert

(m-1) Roughly leaf-shaped to ovoid, convex base, convex edges, relatively thin specimens (Fig. 51, *q–t*) 57

Occurrence by phases, Tularosa Cave:
Pre-Pottery, 8
Pine Lawn, 7
Georgetown, 7
San Francisco, cave floor, 2
San Francisco, 10
San Francisco-through-Tularosa, 8
Reserve-through-Tularosa, 1
Unplaced, 1

Occurrence by phases, Cordova Cave:
Pre-Pottery, 5
Plain Ware, 3
Late, 5

Length: 2.0–4.5 cm.; average, 3.0 cm.
Width: 1.3–3.4 cm.; average, 2.0 cm.
Thickness: 0.3–0.6 cm.; average, 0.4 cm.
Materials: Chert, jasper, obsidian, fine-grained basalt

(m-2) Roughly leaf-shaped to ovoid, convex base, convex edges; relatively thick specimens (Fig. 51, *m–p*) 26

Occurrence by phases, Tularosa Cave:
Pre-Pottery, 7
Pine Lawn, 1
Georgetown, 5
San Francisco, 5
San Francisco-through-Tularosa, 2

Occurrence by phases, Cordova Cave:
Plain Ware, 4
Late, 2

Length: 2.9–5.4 cm.; average, 3.9 cm.
Width: 1.8–3.5 cm.; average, 2.6 cm.
Thickness: 0.5–1.2 cm.; average, 0.8 cm.
Materials: Chert, fine-grained basalt

Projectile Points and Blades—*continued*

(Figures 45–51)

(m-3) Leaf-shaped, convex base, convex edges, thick (Fig. 51, *i–l*) 11

Occurrence by phases, Tularosa Cave:
 Pre-Pottery, 1
 Georgetown, 1
 San Francisco, 1
 San Francisco-through-Tularosa, 3
Occurrence by phases, Cordova Cave:
 Pre-Pottery, 3
 Plain Ware, 2
Length: 2.4–3.4 cm.; average, 2.8 cm.
Width: 1.1–1.8 cm.; average, 1.5 cm.
Thickness: 0.4–0.8 cm.; average, 0.6 cm.
Materials: Fine-grained basalt, chert, obsidian

(m-4) Narrow blades with slightly convex bases and straight edges (Fig. 49, *g*). 9

Occurrence by phases, Cordova Cave:
 Pre-Pottery, 6
 Plain Ware, 1
 Late, 2
Length: 5.2, 5.2 cm., remainder fragments
Width: 1.8–2.5 cm.; average, 2.1 cm.
Thickness: 0.5–1.5 cm.; average, 0.8 cm.
Materials: Fine-grained basalt, chert

(m-5) Convex base fragments of leaf-shaped points 97

Occurrence by phases, Tularosa Cave:
 Pre-Pottery, 18
 Pine Lawn, 8
 Georgetown, 20
 San Francisco, cave floor, 1
 San Francisco, 2
Occurrence by phases, Cordova Cave:
 Pre-Pottery, 28
 Plain Ware, 9
 Late, 11
Width: 1.2–3.5 cm.; average, 2.3 cm.
Thickness: 0.3–1.2 cm.; average, 0.6 cm.
Materials: Fine-grained basalt, chert, jasper

(n-1) Leaf shaped, straight base (Fig. 51, *e–h*) 11

Occurrence by phases, Tularosa Cave:
 Georgetown, 4
 San Francisco, 2
Occurrence by phases, Cordova Cave:
 Plain Ware, 2
 Late, 3
Length: 2.6–4.3 cm.; average, 3.2 cm.
Width: 1.4–2.4 cm.; average, 1.8 cm.
Thickness: 0.4–0.8 cm.; average, 0.6 cm.
Materials: Fine-grained basalt, chert

Projectile Points and Blades—*continued*

(Figures 45–51)

(n-2) Straight base fragments, many with parallel edges 27

Occurrence by phases, Tularosa Cave:
- Pre-Pottery, 3
- Pine Lawn, 1
- San Francisco, 3
- San Francisco-through-Tularosa, 1

Occurrence by phases, Cordova Cave:
- Pre-Pottery, 9
- Plain Ware, 6
- Late, 4

Width: 1.9–3.8 cm.; average, 2.6 cm.
Thickness: 0.4–1.2 cm.; average, 0.7 cm.
Materials: Fine-grained basalt, chert

(o) Blades with points off center, straight bases (Figs. 46, *m*, 51, *a–d*) 28

Occurrence by phases, Tularosa Cave:
- Pre-Pottery, 4
- Pine Lawn, 2
- Georgetown, 7

Occurrence by phases, Cordova Cave:
- Pre-Pottery, 8
- Pine Lawn, 2
- Late, 5

Length: 2.6–5.0 cm.; average, 4.0 cm.
Width: 1.4–3.0 cm.; average, 2.1 cm.
Thickness: 0.5–1.6 cm.; average, 0.8 cm.
Materials: Chert, fine-grained basalt

(p) Lateral notched, expanding base, ear-like barbs, triangular blades with concave bases (Fig. 48, *q–t*) 11

Occurrence by phases, Tularosa Cave:
- San Francisco-through-Tularosa, 1

Occurrence by phases, Cordova Cave:
- Pre-Pottery, 2
- Plain Ware, 2
- Late, 6

Length: 2.1–3.8 cm.; average, 2.9 cm.
Width: 1.6–2.5 cm.; average, 2.0 cm.
Thickness: 0.4–0.6 cm.; average, 0.5 cm.
Materials: Chert, obsidian, fine-grained basalt

(q) Diagonal notched, expanding stem narrower than shoulder, base convex, edges straight, leaf-shaped (Fig. 49, *a*, *b*) 3

Occurrence by phases, Cordova Cave:
- Pre-Pottery, 1
- Plain Ware, 1
- Late, 1

Length, 4.2, 4.2, 3.6 cm.; width, 2.1, 2.0, 1.5 cm.; thickness, 0.4, 0.5, 0.4 cm.
Materials: Obsidian, chert

Projectile Points and Blades—*continued*

(Figures 45–51)

(r) Asymmetrical blades, small expanding stem narrower than shoulder, one obliquely tanged (Fig. 49, *i, j*) 4

Occurrence by phases, Cordova Cave:
Pre-Pottery, 1
Plain Ware, 1
Late, 2
Length, 5.4, 5.0, 5.2, 5.0 cm.; width, 2.7, 3.0, 2.1, 2.2 cm.; thickness, 1.0, 1.1, 0.7, 1.0 cm.
Material: Fine-grained basalt

(s) Small triangular points with lateral notches, two with serrate edges (Fig. 48, *i–l*) 4

Occurrence by phases, Cordova Cave:
Plain Ware, 1
Late, 3
Length, 2.6, 3.6, 1.7, 2.9 cm.; width, 1.2, 1.0, 1.0, 1.3 cm.; thickness, 0.3, 0.3, 0.2, 0.2 cm.
Materials: Obsidian, chert

(t) Small round stem, round shoulder, shallow notched (Fig. 49, *c–d*) 2

Occurrence by phases, Cordova Cave:
Late, 2
Length, 3.3, 2.5 cm.; width, 1.8, 1.8 cm.; thickness, 0.5, 0.6 cm.
Materials: Obsidian, chert

(u) Chip points; thin leaf-shaped flakes modified mostly on edges, lateral notched, one with basal notches and serrate edge (Fig. 48, *m–p*) 5

Occurrence by phases, Tularosa Cave:
San Francisco-through-Tularosa, 1
Occurrence by phases, Cordova Cave:
Pre-Pottery, 4
Length, 3.5, 2.8, 3.2, 2.8, 2.3 cm.; width, 1.7, 2.1, 2.3, 2.0, 1.8 cm.; thickness, 0.5, 0.1, 0.4, 0.3, 0.4 cm.
Materials: Fine-grained basalt, chert

(v) Miscellaneous specimens (Fig. 45, *u, v, w, x*): (1) Isosceles triangular blade; (2) very thin shouldered tips; (3) lateral notched base; (4) indented base; (5) lateral notched with projecting ears; (6) contracting stem; (7) obliquely flaked leaf-shaped blade 8

Occurrence by phases:
(1) Georgetown Phase; (2) Pre-Pottery Phase, two specimens; (3) Reserve-through-Tularosa Phase; (4) Pre-Pottery Phase; (5) Georgetown Phase; (6) Plain Ware Phase; (7) Pre-Pottery Phase. 1–5 from Tularosa Cave; 6 and 7 from Cordova Cave
Length: 4.0, 5.3, fragments, 2.4, 4.3, 5.7 cm.
Width: 3.0, 1.3, 2.9, 2.6, 1.6, 1.9, 3.1 cm.
Thickness: 0.6, 0.2, 0.7, 0.7, 0.4, 0.7, 1.1 cm.

(w) Too fragmentary to classify 121

Occurrence by phases, Tularosa Cave:
Pre-Pottery, 18
Pine Lawn, 9
Georgetown, 9
San Francisco, 6
San Francisco-through-Tularosa, 3
Occurrence by phases, Cordova Cave:
Pre-Pottery, 38
Plain Ware, 19
Late, 19
Of these fragments 102 are tips.
Materials: Chert, fine-grained basalt, obsidian

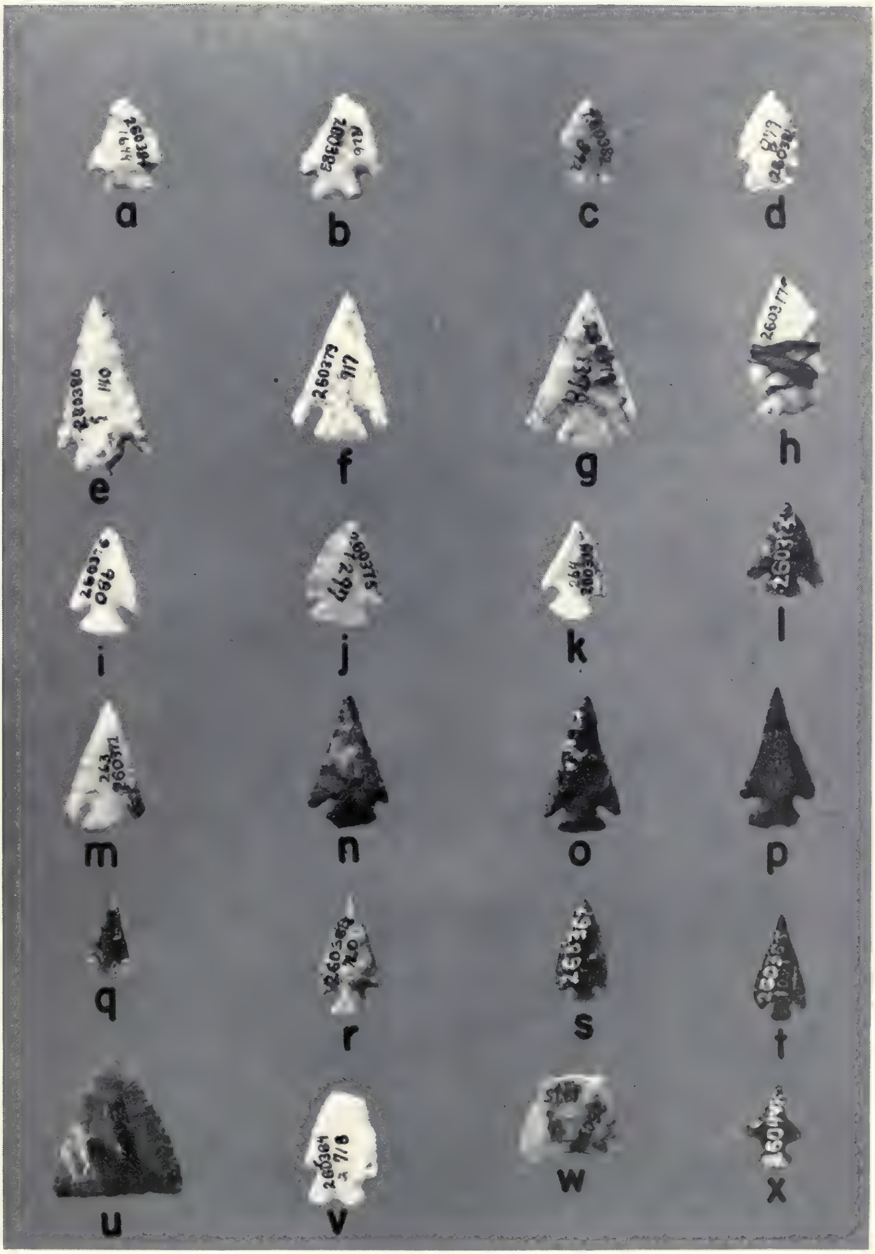
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FIG. 45. Projectile points, Tularosa Cave. Length of *x*, 2.4 cm.

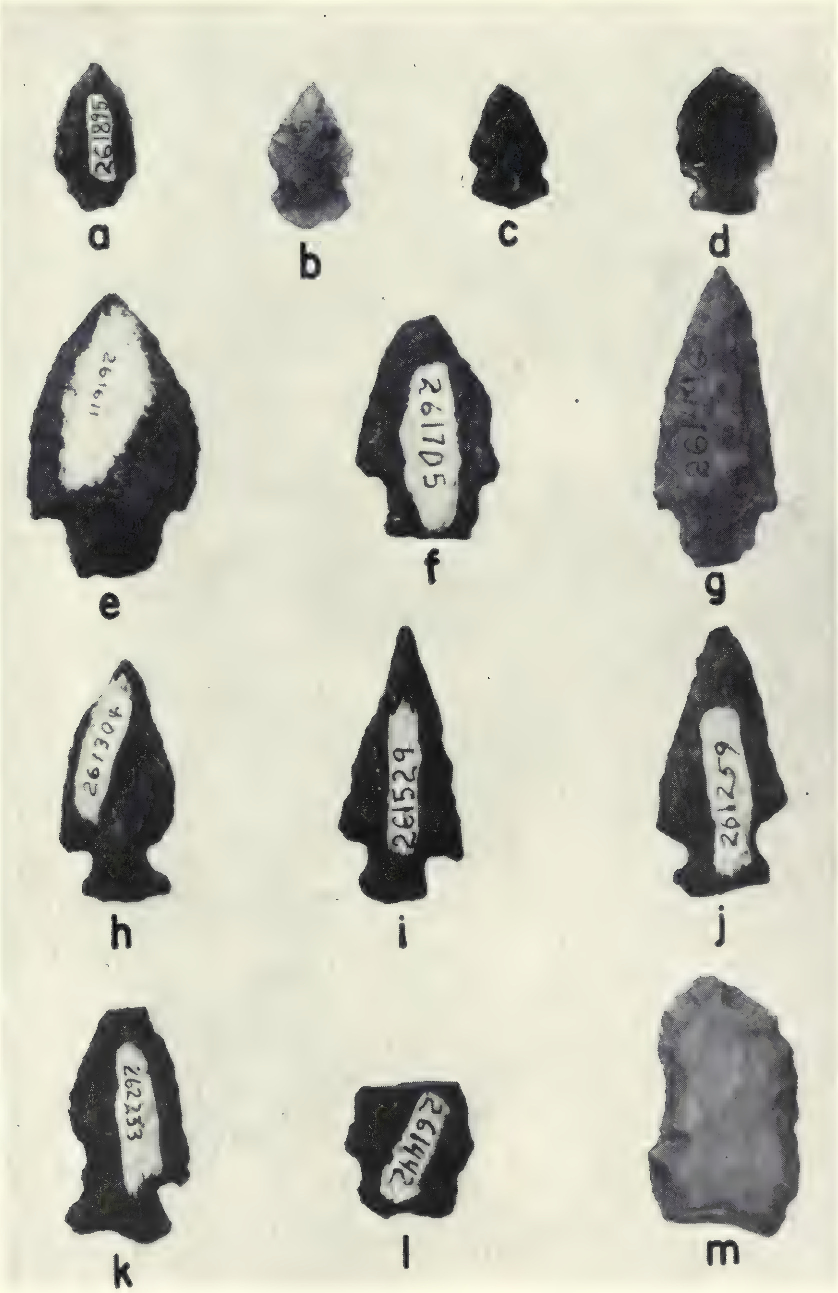
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FIG. 46. Projectile points and blades, Cordova Cave, from Pre-Pottery levels. Length of *m*, 4.5 cm.

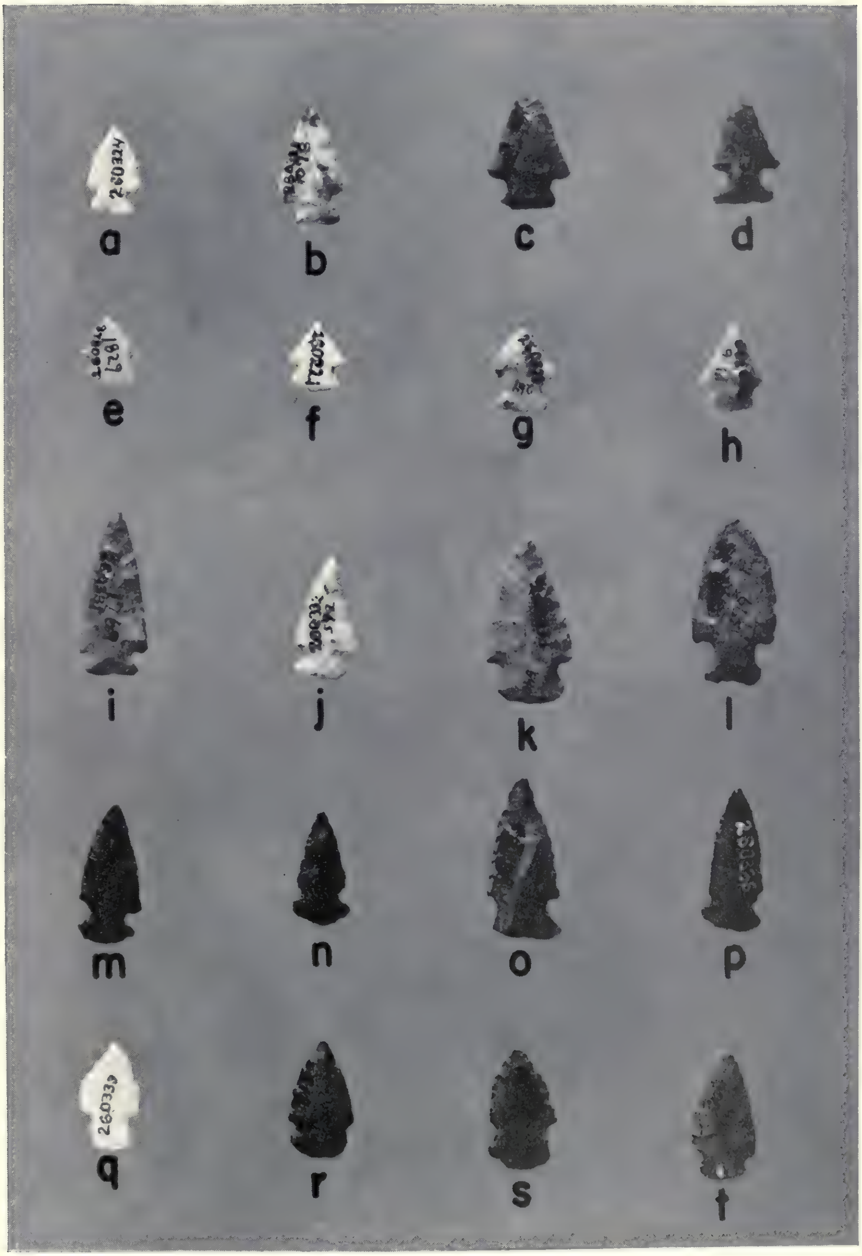
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FIG. 47. Projectile points, Tularosa Cave. Length of *t*, 3.5 cm.

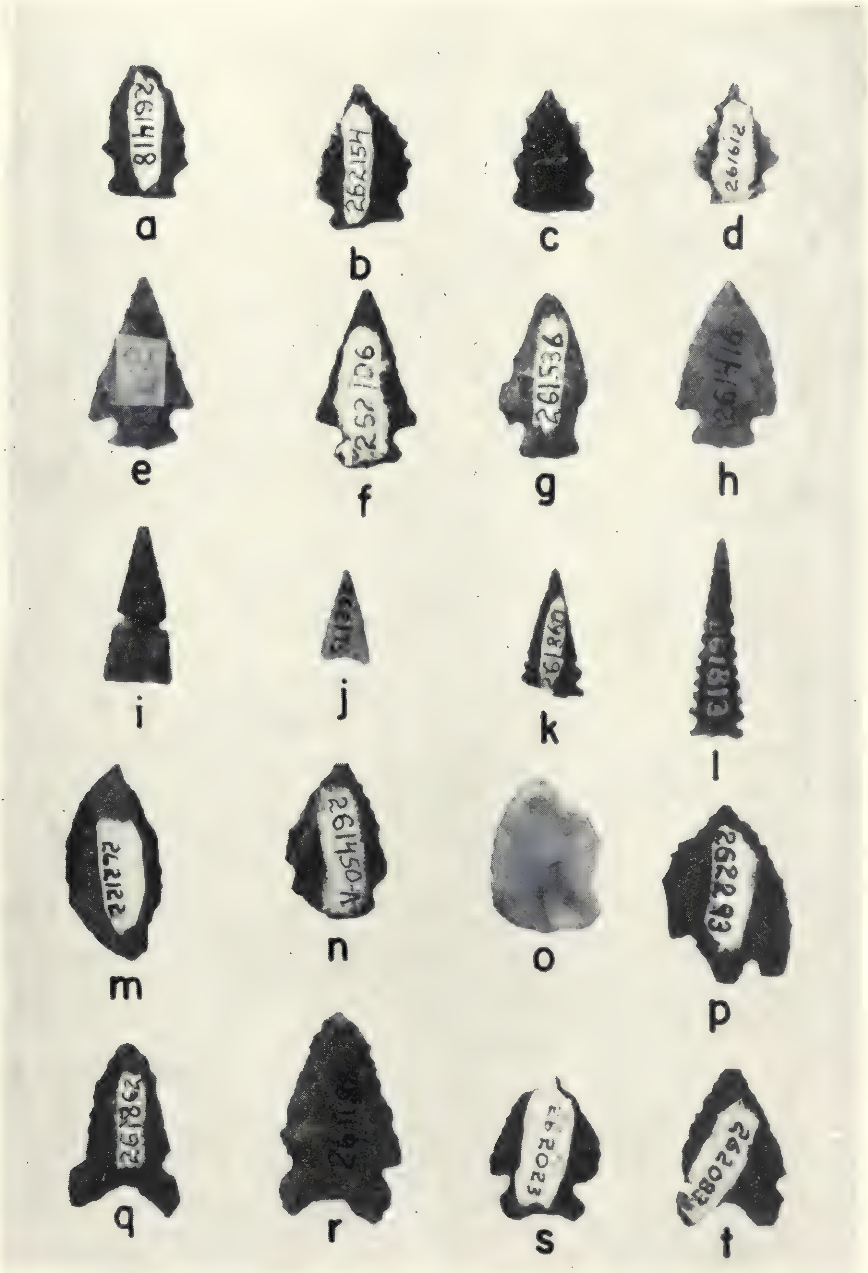
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FIG. 48. Projectile points, Cordova Cave. Length of *t*, 2.9 cm.

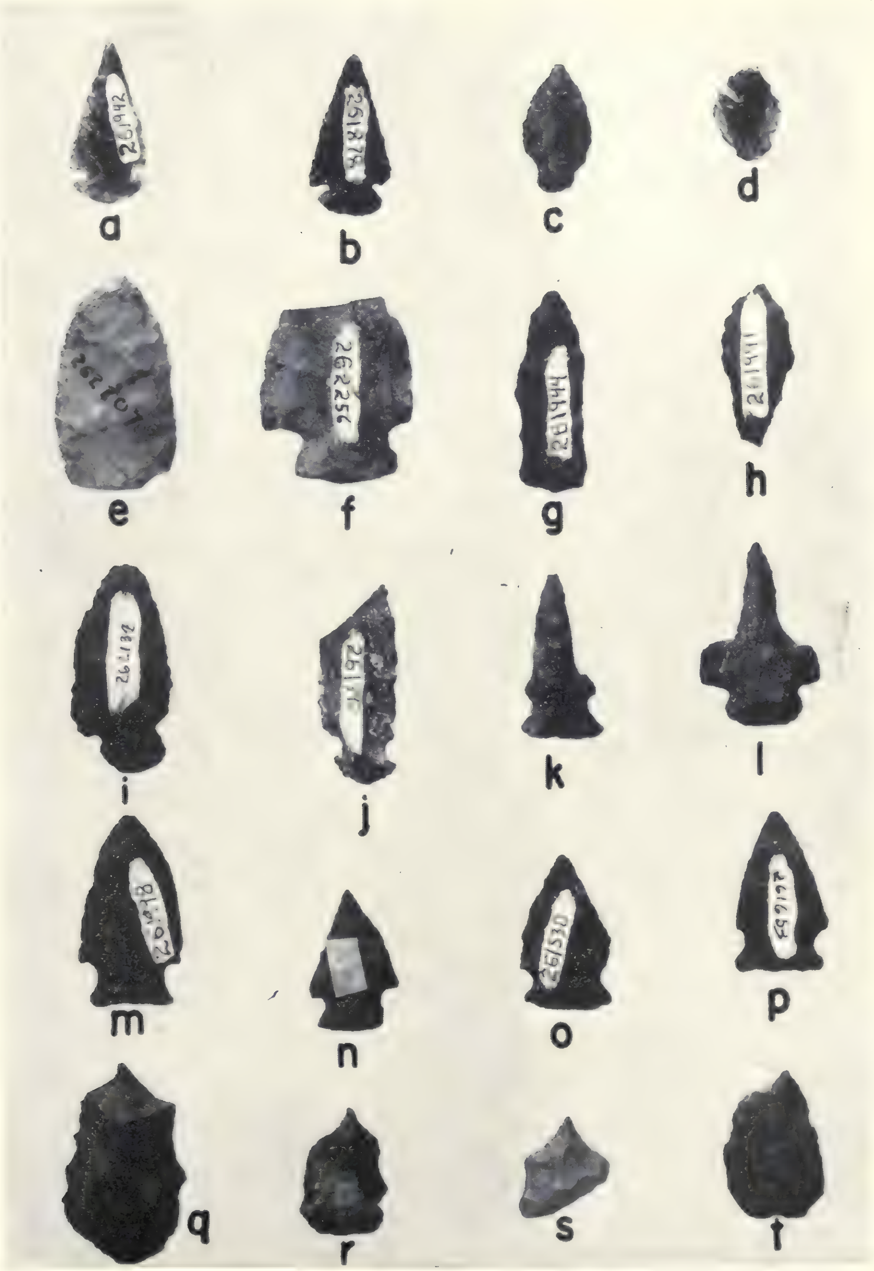
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FIG. 49. Projectile points, blades, drills, and gravers, Cordova Cave. Length of *t*, 3.9 cm.

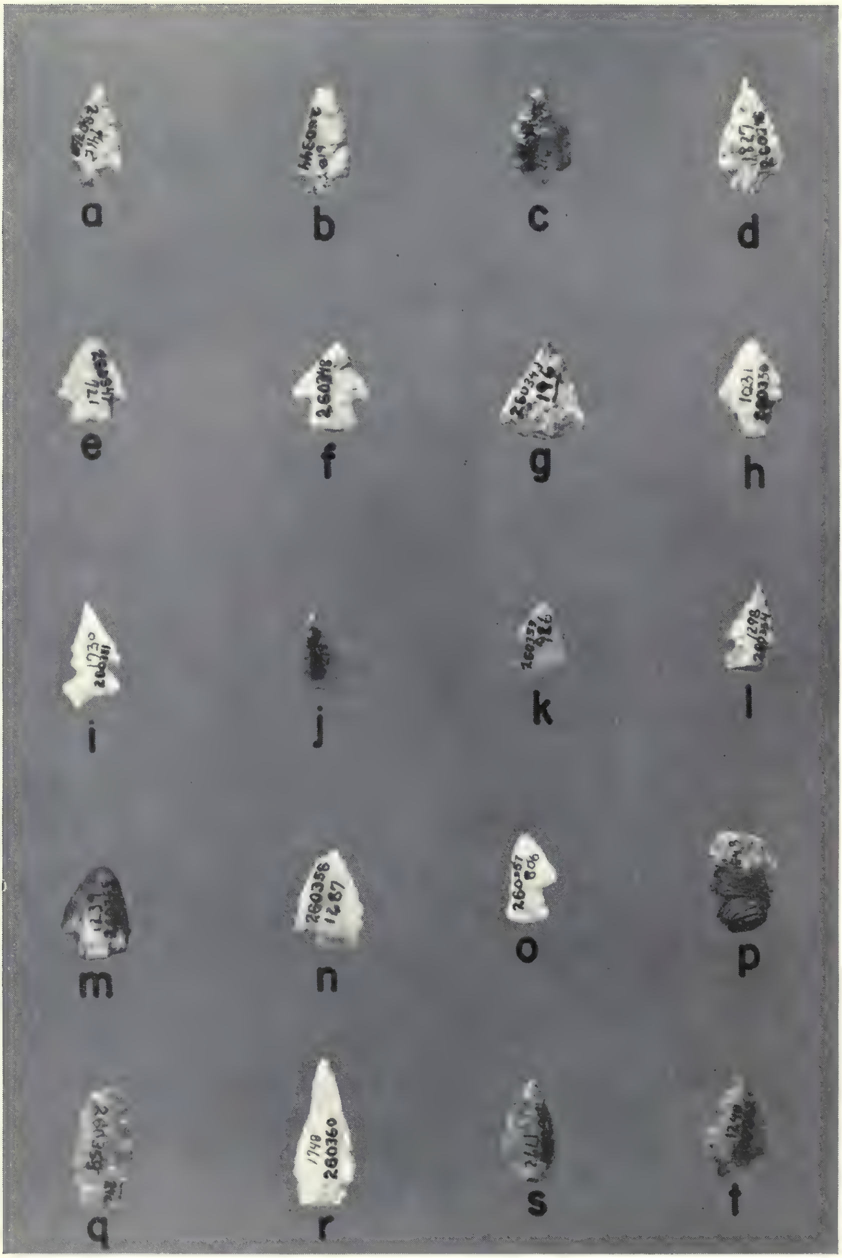
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FIG. 50. Projectile points and blades, Tularosa Cave. Length of *t*, 2.9 cm.

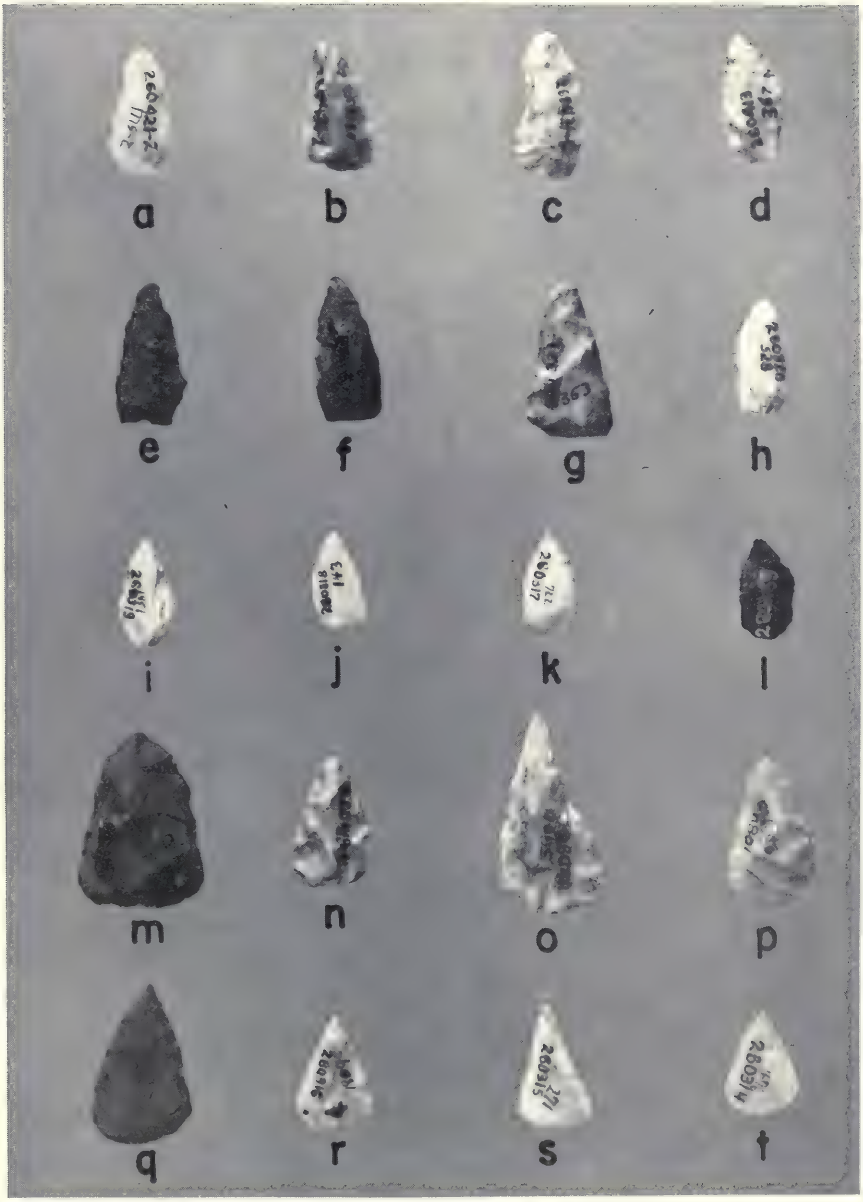
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FIG. 51. Projectile points and blades, Tularosa Cave. Length of *t*, 2.8 cm.

Flake Knives

(Figure 52)

(a) Random flake type, any suitable thin flake with some chipping along one or more edges, frequently through use; no regularity of outline...... 826

Occurrence by phases, Tularosa Cave:
  Pre-Pottery, 60
  Pine Lawn, 38
  Pine Lawn-through-Georgetown, 6
  Georgetown, 99
  San Francisco, cave floor, 18
  San Francisco, 69
  San Francisco-through-Tularosa, 92
  Reserve-through-Tularosa, 4
  Unplaced, 1

Occurrence by phases, Cordova Cave:
  Pre-Pottery, 241
  Plain Ware, 124
  Late, 74

Length: 1.5–6.0 cm.; average, 3.0 cm.

Width: 1.1–4.6 cm.; average, 2.1 cm.

Thickness: 0.2–0.9 cm.; average, 0.5 cm.

Materials: Chert, jasper, chalcedony, obsidian, fine-grained basalt

(b) Thin unnotched flake knives with curved edges and secondary chipping on all major surfaces.. 21

Occurrence by phases, Tularosa Cave:
  Pre-Pottery, 1
  Pine Lawn, 1
  Georgetown, 1
  San Francisco, cave floor, 1
  San Francisco, 1

Occurrence by phases, Cordova Cave:
  Pre-Pottery, 10
  Plain Ware, 2
  Late, 4

Length: 1.5–6.5 cm.; average, 3.6 cm.

Width: 1.5–3.3 cm.; average, 2.2 cm.

Thickness: 0.3–0.9 cm.; average, 0.5 cm.

Materials: Chert, obsidian, fine-grained basalt

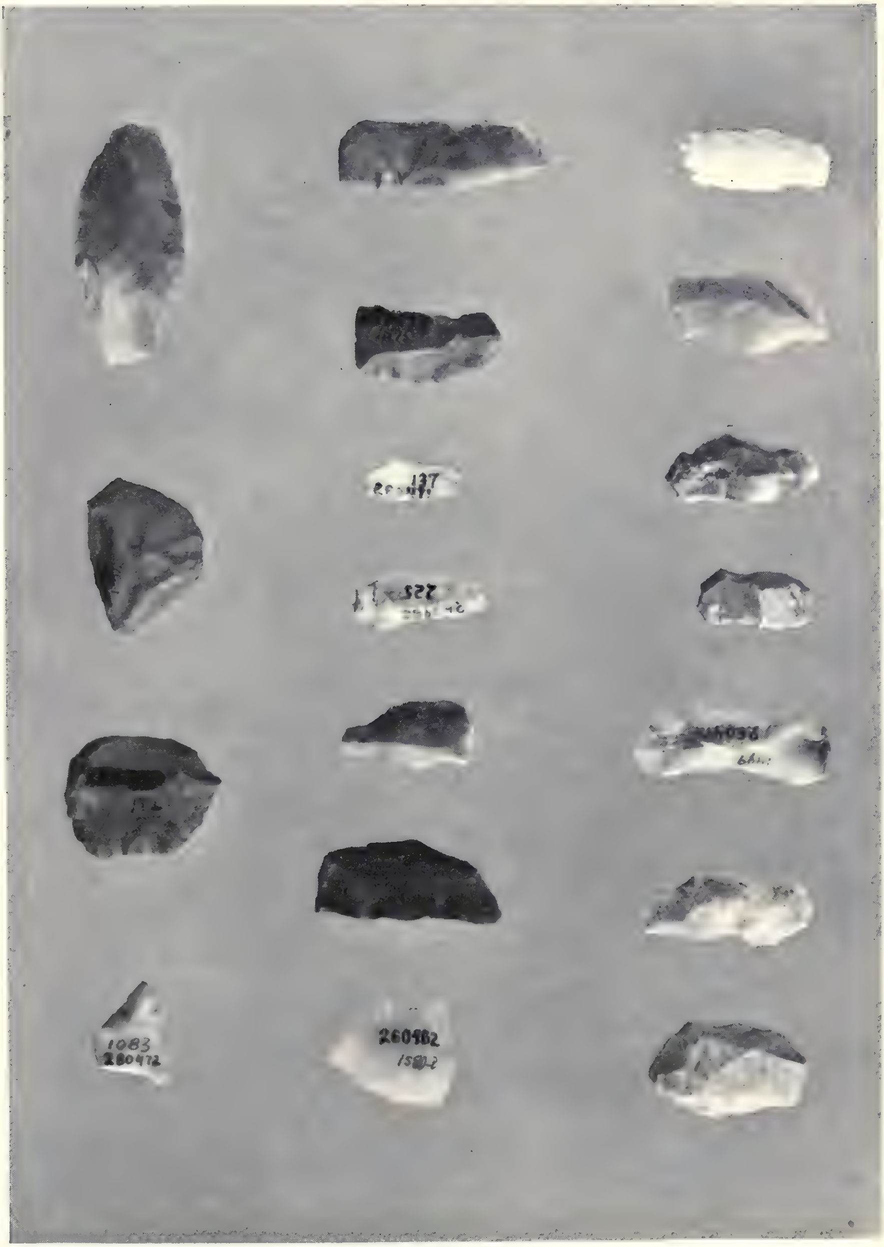
137
1083
280472
260462

FIG. 52. Knives. Length of right specimen (bottom row), 4.3 cm.

Scrapers

(Figures 53–57)

Side scrapers:

(a) Random thick flakes with poorly directed retouch (possibly from use) along one edge, plano-convex in cross section; convex surface shaped by percussion chipping; no regularity of outline (Fig. 53, *c, f, i, l*) 316

Occurrence by phases, Tularosa Cave:
- Pre-Pottery, 27
- Pine Lawn, 22
- Georgetown, 28
- San Francisco, cave floor, 2
- San Francisco, 31
- San Francisco-through-Tularosa, 12
- Reserve-through-Tularosa, 3

Occurrence by phases, Cordova Cave:
- Pre-Pottery, 75
- Plain Ware, 67
- Late, 49

Length: 2.3–7.4 cm.; average, 4.3 cm.

Width: 1.6–6.2 cm.; average, 3.1 cm.

Thickness: 0.5–3.0 cm.; average, 1.2 cm.

Materials: Fine-grained basalt, rhyolite, chert

(b) Large, rough, thick angular flakes, generally plano-convex in cross section with steep retouch (30° to 90°) along one edge (Fig. 54).. 144

Occurrence by phases, Tularosa Cave:
- Pre-Pottery, 16
- Pine Lawn, 25
- Pine Lawn-through-Georgetown, 2
- Georgetown, 23
- San Francisco, cave floor, 1
- San Francisco, 18
- San Francisco-through-Tularosa, 11

Occurrence by phases, Cordova Cave:
- Pre-Pottery, 16
- Plain Ware, 13
- Late, 19

Length: 5.0–16.2 cm.; average, 7.3 cm.

Width: 3.0–12.8 cm.; average, 5.6 cm.

Thickness: 0.9–4.0 cm.; average, 2.5 cm.

Materials: Fine-grained basalt, rhyolite, jasper

Scrapers—*continued*

(Figures 53–57)

(c) Small, rough, thick angular flakes, generally plano-convex in cross section with steep retouch (30° to 90°) along one edge (Fig. 55) . . 87

Occurrence by phases, Tularosa Cave:
Pre-Pottery, 10
Pine Lawn, 5
Pine Lawn-through-Georgetown, 1
Georgetown, 10
San Francisco, 9
San Francisco-through-Tularosa, 12
Reserve-through-Tularosa, 1

Occurrence by phases, Cordova Cave:
Pre-Pottery, 20
Plain Ware, 5
Late, 14

Length: 2.7–6.5 cm.; average, 5.5 cm.

Width: 1.4–5.9 cm.; average, 4.4 cm.

Thickness: 0.8–3.6 cm.; average, 1.8 cm.

Materials: Fine-grained basalt, rhyolite, chert

(d) Small thin flakes with flat retouch along one edge (Fig. 56, *a–d*, *f*, *h*) . 63

Occurrence by phases, Tularosa Cave:
Pre-Pottery, 3
Pine Lawn, 4
Georgetown, 10
San Francisco, 11
San Francisco-through-Tularosa, 6
Reserve-through-Tularosa, 2

Occurrence by phases, Cordova Cave
Pre-Pottery, 15
Plain Ware, 5
Late, 7

Length: 2.7–7.6 cm.; average, 4.2 cm.

Width: 2.3–4.7 cm.; average, 3.2 cm.

Thickness: 0.5–1.7 cm.; average, 0.8 cm.

Materials: Fine-grained basalt, chert

(e) Thick nodules, generally circular in outline, plano-convex in cross section with sides steeply chipped into deep notches forming a large-toothed serrate edge (Fig. 56, *e*, *g*) 10

Occurrence by phases, Tularosa Cave:
Pine Lawn, 1
Georgetown, 1

Occurrence by phases, Cordova Cave:
Pre-Pottery, 4
Plain Ware, 2
Late, 2

Length: 3.9–8.2 cm.; average, 6.5 cm.

Width: 3.7–6.7 cm.; average, 5.5 cm.

Thickness: 1.5–5.5 cm.; average, 2.7 cm.

Materials: Fine-grained basalt, rhyolite

Scrapers—*continued*

(Figures 53–57)

(f) Thick long implements with keel-shaped cross section; percussion chipping on convex surface; secondary chipping from use on edges and occasionally on ends (Fig. 53, *a, d, g, j*) 13

Occurrence by phases, Tularosa Cave:
  Pine Lawn, 1
  Georgetown, 4
  San Francisco, 1
  San Francisco-through-Tularosa, 2
Occurrence by phases, Cordova Cave:
  Pre-Pottery, 2
  Plain Ware, 1
  Late, 2
Length: 4.0–8.0 cm.; average, 5.4 cm.
Width: 2.2–5.1 cm.; average, 3.3 cm.
Thickness: 1.2–3.1 cm.; average, 1.9 cm.
Materials: Fine-grained basalt, chert, rhyolite

(g) Thick convex flakes with chipping on both surfaces and one or more edges (Fig. 57, *a, d*) 104

Occurrence by phases, Tularosa Cave:
  Pre-Pottery, 15
  Pine Lawn, 9
  Pine Lawn-through-Georgetown, 2
  Georgetown, 21
  San Francisco, cave floor, 1
  San Francisco, 8
  San Francisco-through-Tularosa, 10
Occurrence by phases, Cordova Cave:
  Pre-Pottery, 16
  Plain Ware, 11
  Late, 11
Length: 2.2–9.3 cm.; average, 4.4 cm.
Width: 1.7–5.8 cm.; average, 3.0 cm.
Thickness: 0.6–3.0 cm.; average, 1.4 cm.
Materials: Fine-grained basalt, chert, jasper

Hollow-edged scrapers:

Random thick flakes with one or more indentations chipped into the edge (Fig. 53, *b, e, h, k*) 12

Occurrence by phases, Tularosa Cave:
  Georgetown, 1
  San Francisco, 2
  San Francisco-through-Tularosa, 1
Occurrence by phases, Cordova Cave:
  Pre-Pottery, 7
  Late, 1
Length: 2.9–7.1 cm.; average, 3.8 cm.
Width: 1.0–4.0 cm.; average, 2.4 cm.
Thickness: 0.3–1.3 cm.; average, 0.7 cm.
Materials: Chert, obsidian, fine-grained basalt

Scrapers—*continued*

(Figures 53–57)

End scrapers:

(a) Elongate flakes, oval in outline, plano-convex to keel shape in cross section; secondary chipping on convex surface and at broad end on plane surface; narrow end of plane surface unaltered (Fig. 57, *b*, *e*, *h*, *k*) 19

Occurrence by phases, Tularosa Cave:
Pre-Pottery, 2
Georgetown, 6
San Francisco, 1

Occurrence by phases, Cordova Cave:
Pre-Pottery, 7
Plain Ware, 1
Late, 2

Length: 2.1–5.9 cm.; average, 3.8 cm.

Width: 1.6–3.6 cm.; average, 2.7 cm.

Thickness: 0.5–1.9 cm.; average, 1.0 cm.

Materials: Chert, obsidian

(b) Flakes with square ends bearing steep retouch (Fig. 57, *c*, *f*, *i*, *l*) .. 13

Occurrence by phases, Tularosa Cave:
Pre-Pottery, 3
San Francisco-through-Tularosa, 3
Reserve-through-Tularosa, 1

Occurrence by phases, Cordova Cave:
Pre-Pottery, 3
Pine Lawn, 1
Late, 2

Length: 2.4–5.5 cm.; average, 3.2 cm.

Width: 1.0–4.2 cm.; average, 2.1 cm.

Thickness: 0.6–1.2 cm.; average, 0.9 cm.

Materials: Chert, obsidian

Discoidals:

Roughly disk form, plano-convex in cross section; chipped all over convex surface 4

Occurrence by phases, Cordova Cave:
Pre-Pottery, 2
Late, 2

Diameter, 2.4, 3.1, 2.7, 2.8 cm.; thickness, 1.0, 0.9, 0.7, 1.2 cm.

Materials: Chert, obsidian, fine-grained basalt

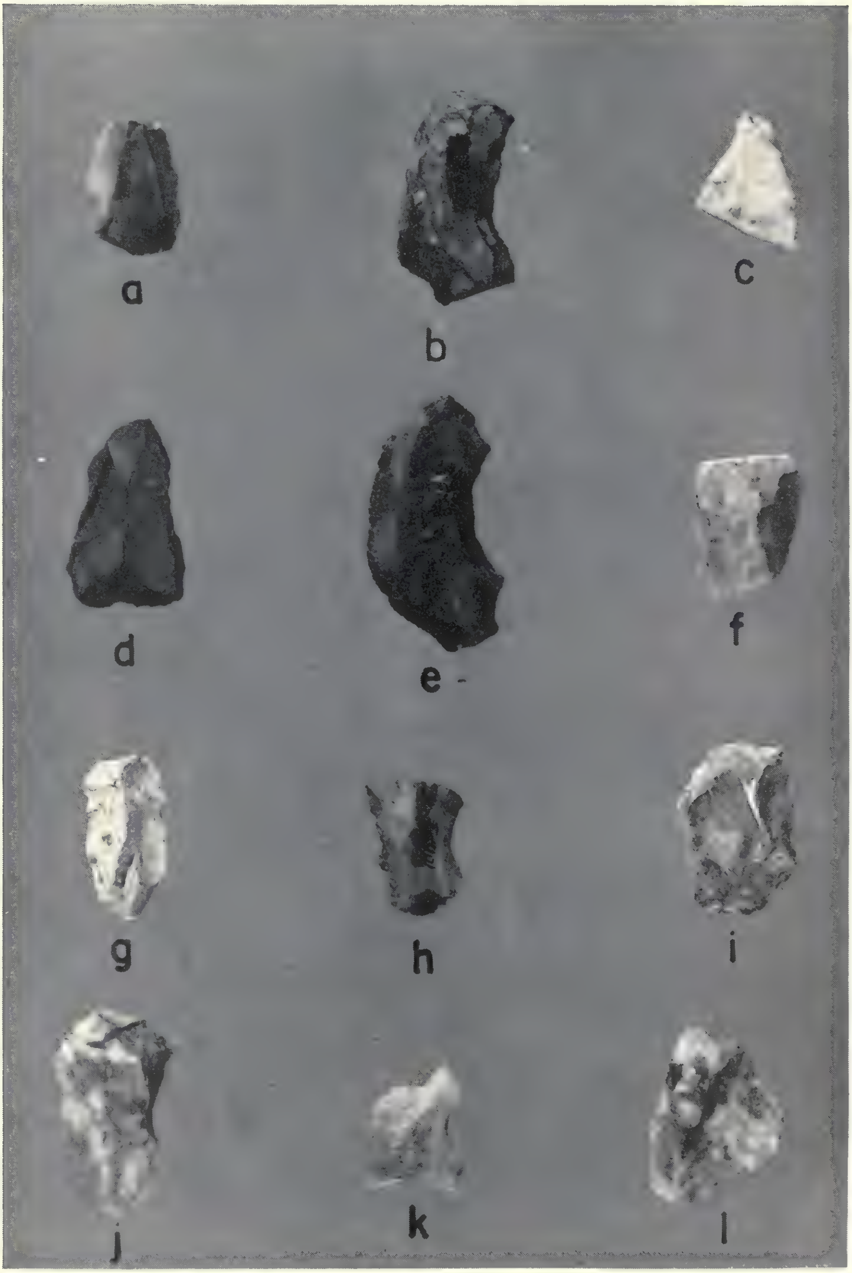
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FIG. 53. Keeled scrapers (*a, d, g, j*), hollow scrapers (*b, e, h, k*), and random flake scrapers (*c, f, i, l*). Length of *l*, 4.7 cm.

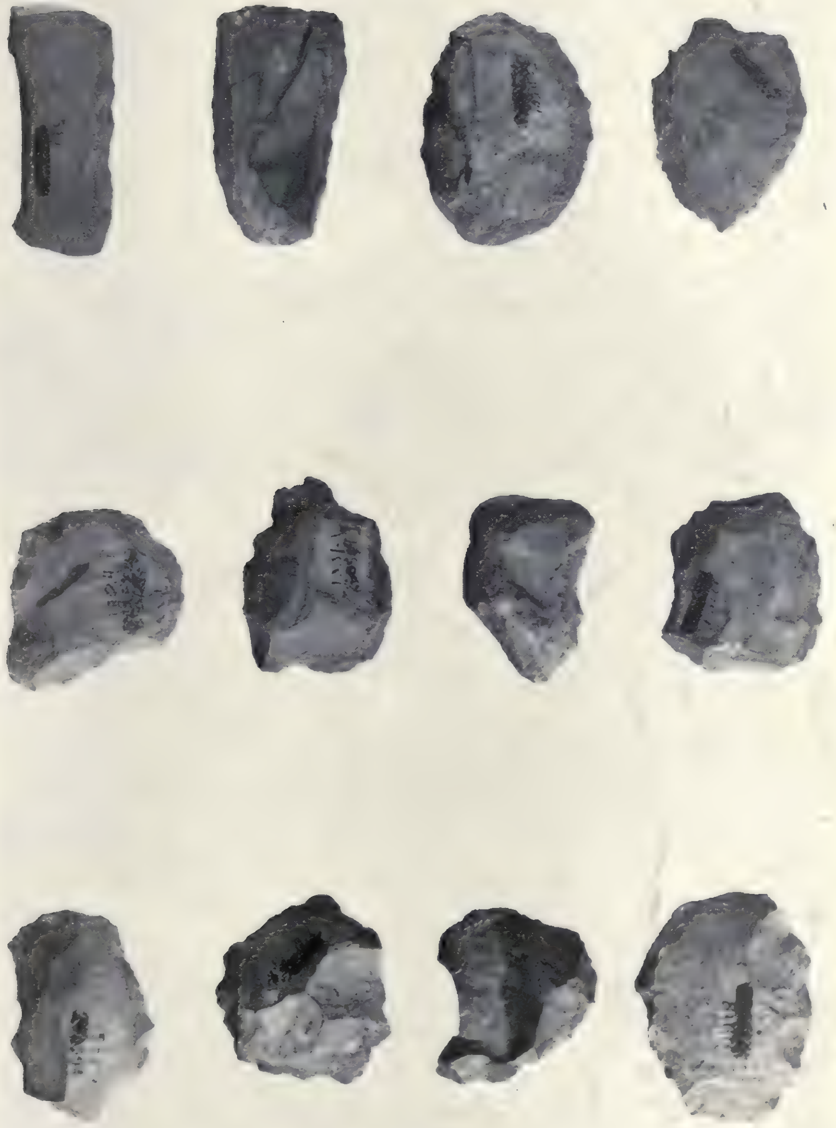

FIG. 54. Large, rough, thick side scrapers. Length of right specimen (bottom row), 8.5 cm.

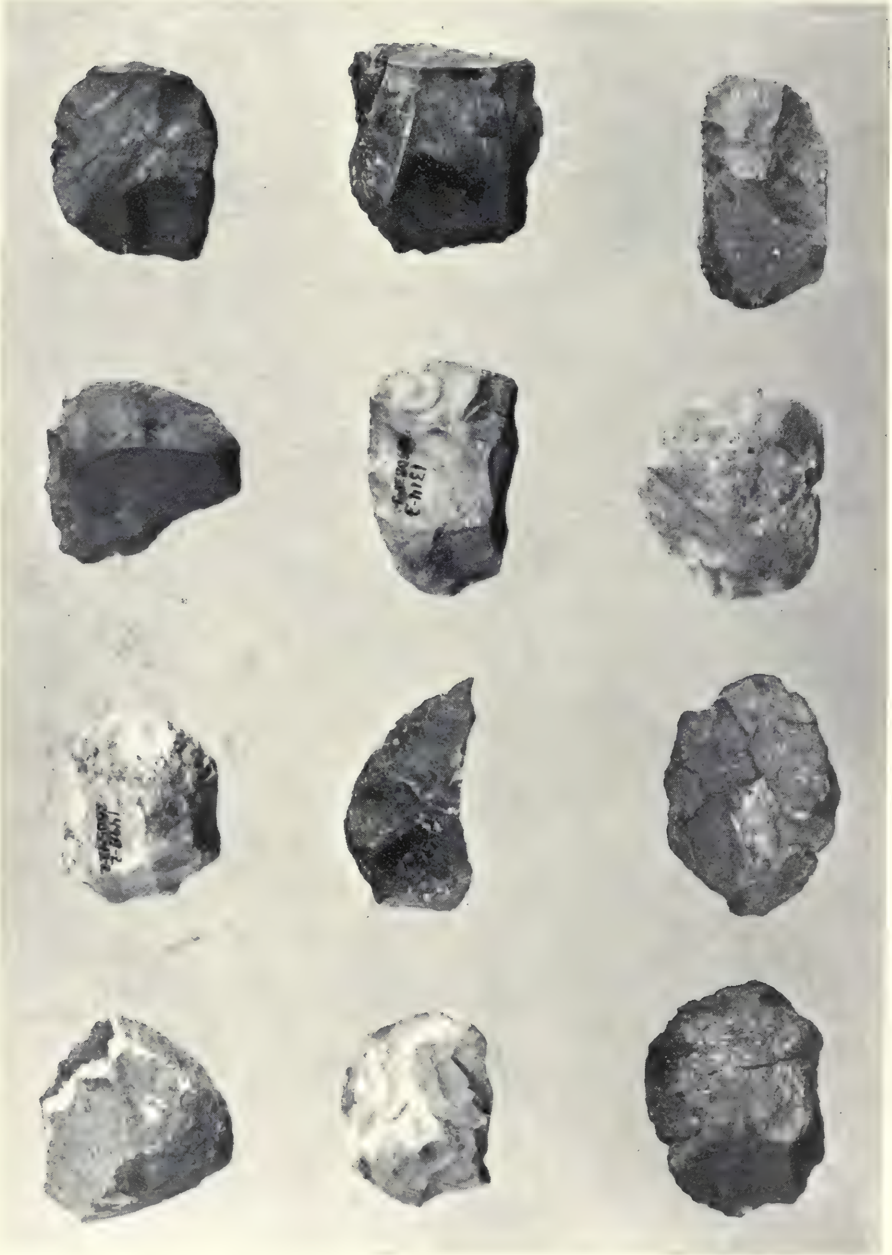

FIG. 55. Small, rough, thick side scrapers. Length of right specimen (bottom row), 6.2 cm.

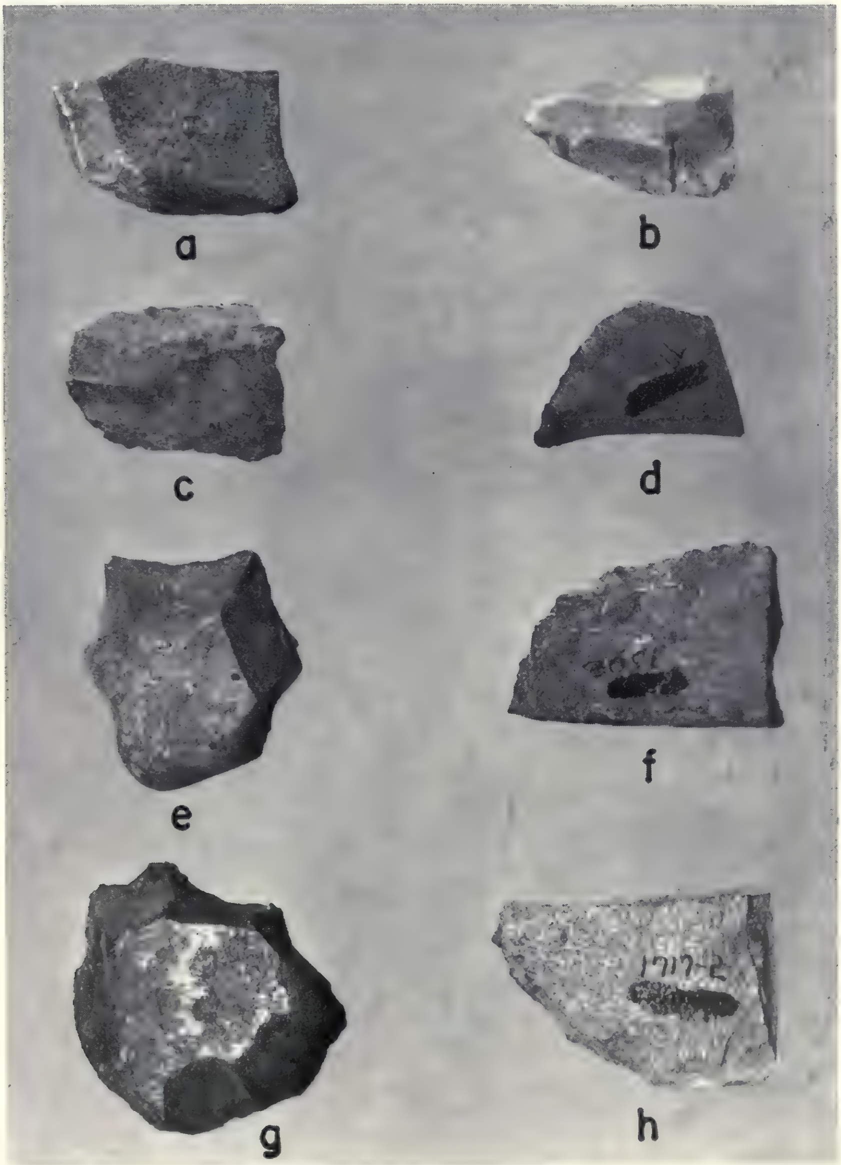

FIG. 56. Serrate scrapers (*e*, *g*) and thin, flake side scrapers (*a–d*, *f*, *h*). Length of *h*, 6.3 cm.

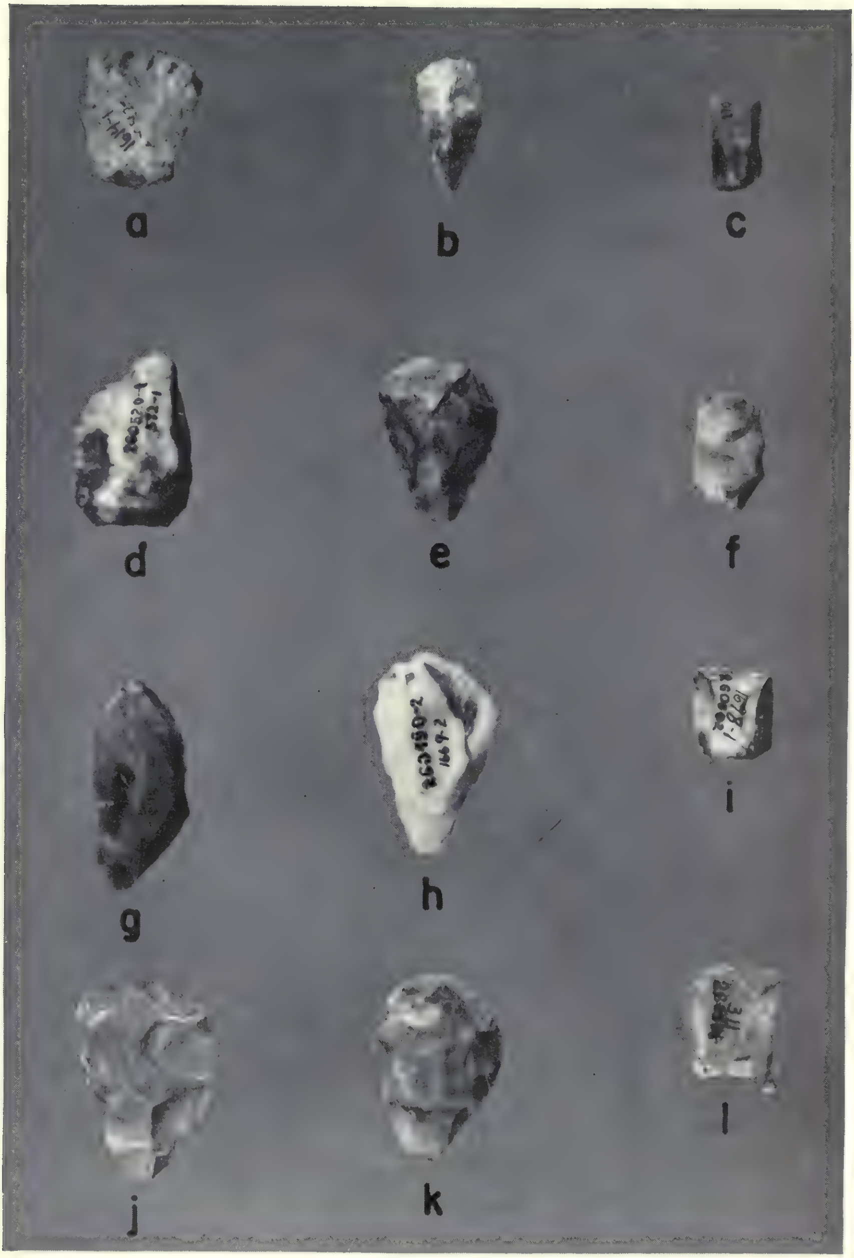
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FIG. 57. Biface scrapers (*a*, *d*) and end scrapers (*b*, *c*, *e*, *f*, *g–l*). Length of *l*, 2.9 cm.

Choppers

(Figures 58, 59)

(a-1) Plano-convex choppers, or scraper planes; large thick angular implements, roughly semicircular in outline; percussion flaked part way around margin to produce sharp cutting edge; two specimens with deeply indented serrate edges; flaked from one surface only (Fig. 58). 79

Occurrence by phases, Tularosa Cave:
- Pre-Pottery, 1
- Pine Lawn, 1
- Georgetown, 2
- San Francisco, cave floor, 1
- San Francisco, 1
- San Francisco-through-Tularosa, 2

Occurrence by phases, Cordova Cave:
- Pre-Pottery, 17
- Plain Ware, 20
- Late, 34

Length: 5.8–14.1 cm.; average, 8.9 cm.

Width: 4.6–11.0 cm.; average, 7.1 cm.

Thickness: 2.2–9.5 cm.; average, 4.6 cm.

Materials: Basalt, rhyolite

(a-2) Made from pebbles; part of original surface of pebble left intact; roughly rectangular in outline; one specimen with pebble corner beveled and polished (Fig. 58)................................ 6

Occurrence by phases, Tularosa Cave:
- Pre-Pottery, 1
- Georgetown, 2
- San Francisco, 3

Length: 7.0, 8.4, 7.4, 7.0, 9.0, 9.1 cm.

Width: 6.0, 7.3, 7.5, 6.4, 8.4, 8.4 cm.

Thickness: 4.1, 2.5, 3.5, 3.0, 3.4, 4.4 cm.

Material: Basalt

Choppers—*continued*

(Figures 58, 59)

(b-1) Thick angular core implements percussion flaked on two surfaces to form a sharp cutting edge; trimmed to edge part way around; one surface trimmed or left flat for grip; small areas of original crust of pebble left intact on some specimens (Fig. 59) 115

Occurrence by phases, Tularosa Cave:
- Pre-Pottery, 12
- Pine Lawn, 8
- Pine Lawn-through-Georgetown, 3
- Georgetown, 15
- San Francisco, cave floor, 2
- San Francisco, 22
- San Francisco-through-Tularosa, 14
- Reserve-through-Tularosa, 6
- Unplaced, 2

Occurrence by phases, Cordova Cave:
- Pre-Pottery, 3
- Pine Lawn, 6
- Late, 22

Length: 5.6–14.4 cm.; average, 8.6 cm.

Width: 5.0–12.2 cm.; average, 7.1 cm.

Thickness: 1.8–8.5 cm.; average, 4.5 cm.

Materials: Basalt, chert, rhyolite

(b-2) Made from pebbles with part of margin trimmed by percussion flaking to form a sharp cutting edge; original surface of pebble forms a flat smooth surface for grip 19

Occurrence by phases, Tularosa Cave:
- Pre-Pottery, 5
- Pine Lawn, 3
- Georgetown, 4
- San Francisco, cave floor, 1
- San Francisco, 6

Length: 7.3–13.4 cm.; average, 9.6 cm.

Width: 5.3–10.0 cm.; average, 7.6 cm.

Thickness: 2.3–5.2 cm.; average, 3.5 cm.

Material: Basalt

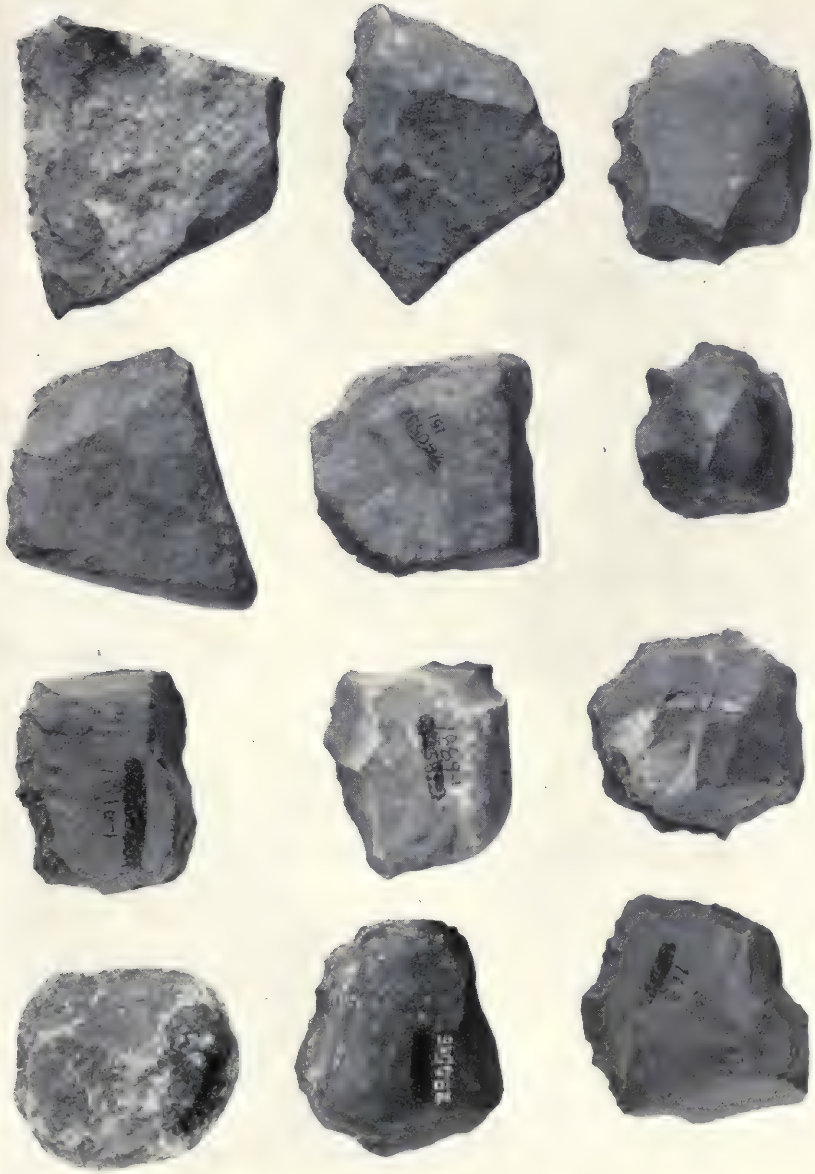


FIG. 58. Scraper planes and uniface pebble choppers. Length of right specimen (bottom row), 9.3 cm.

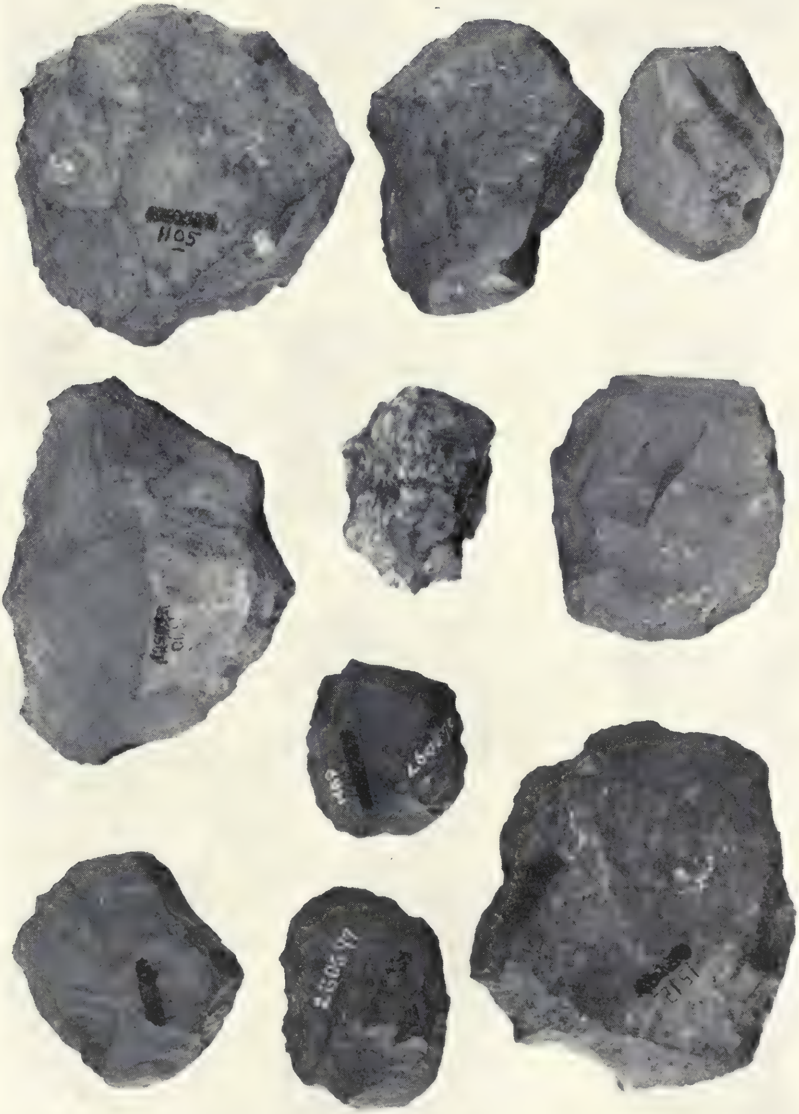


FIG. 59. Biface choppers. Length of right specimen (bottom row), 13.9 cm.

Drills

(Figures 49, 60)

(a-1) Sharpened slender flakes tapering gradually to a point; wedge-shaped in cross section (Fig. 60, *e*, *k*) 6

Occurrence by phases, Tularosa Cave:
  Pine Lawn-through-Georgetown, 1
  Georgetown, 2
  San Francisco-through-Tularosa, 2
Occurrence by phases, Cordova Cave:
  Pre-Pottery, 1
Length: 5.0, 4.1, 3.2, 2.5, 3.2 cm., one fragment
Width: 1.6, 1.1, 1.0, 1.2, 1.5, 1.5 cm.
Thickness: 1.3, 1.3, 0.3, 0.6, 0.7, 0.5 cm.
Material: Chert

(a-2) Sharpened flakes with point tapering from a relatively wide base (Fig. 60, *a–d*) 3

Occurrence by phases, Tularosa Cave:
  Pre-Pottery, 1
  Georgetown, 1
  Reserve-through-Tularosa, 1
Length, 2.7, 2.4, 2.5 cm.; width, 1.4, 1.4, 1.8 cm.; thickness, 0.5, 0.4, 0.4 cm.
Materials: Chert, chalcedony

(b) Plain shafted type; long slender pointed flakes, biconvex in cross section with secondary chipping on both surfaces and edges; tapers to a point (Fig. 60, *s–v*) 8

Occurrence by phases, Tularosa Cave:
  Pre-Pottery, 1
  Pine Lawn, 2
  Georgetown, 2
  San Francisco-through-Tularosa, 1
Occurrence by phases, Cordova Cave:
  Pre-Pottery, 1
  Late, 1
Length: 4.5, 4.7, 6.2, 5.0, 4.0, 2.8, 3.7, 6.0 cm.
Width: 1.2, 1.5, 1.4, 1.5, 1.8, 1.3, 1.5, 2.0 cm.
Thickness: 0.6, 0.8, 0.7, 0.5, 0.9, 0.7, 0.8, 0.6 cm.
Materials: Chert, chalcedony, fine-grained basalt

(c-1) Small, abruptly widening flange with slender tapering point (Fig. 60, *m–p*) 8

Occurrence by phases, Tularosa Cave:
  Pre-Pottery, 2
  Pine Lawn, 1
  Georgetown, 1
  San Francisco-through-Tularosa, 1
Occurrence by phases, Cordova Cave:
  Pre-Pottery, 2
  Plain Ware, 1
Length: 3.1, 4.2, 4.3, 4.0, 3.4, 4.9, 4.6, 4.8 cm.
Width: 1.8, 1.9, 1.5, 2.0, 2.1, 1.9, 1.4, 1.8 cm.
Thickness: 0.5, 0.6, 0.4, 0.5, 0.8, 0.6, 0.3, 0.5 cm.
Materials: Chert, chalcedony, fine-grained basalt

Drills—*continued*

(Figures 49, 60)

(c-2) Slender points tapering from relatively large, broad base (Fig. 60, *g–j*) . 8

Occurrence by phases, Tularosa Cave:
Pine Lawn-through-Georgetown, 3
San Francisco, 2
Occurrence by phases, Cordova Cave:
Pre-Pottery, 2
Plain Ware, 1
Length: 3.1, 5.6, 4.5, 3.0, 2.8, fragment, 4.8, 4.7 cm.
Width: 1.5, 2.0, 2.5, 2.3, 1.8, 2.4, 2.6, 2.2 cm.
Thickness: 0.3, 1.0, 1.2, 0.6, 0.8, 0.9, 0.9, 1.2 cm.
Materials: Chert, fine-grained basalt, trachyte

(c-3) Wing-like extension of flange above base (Fig. 49, *k*, *l*) 2

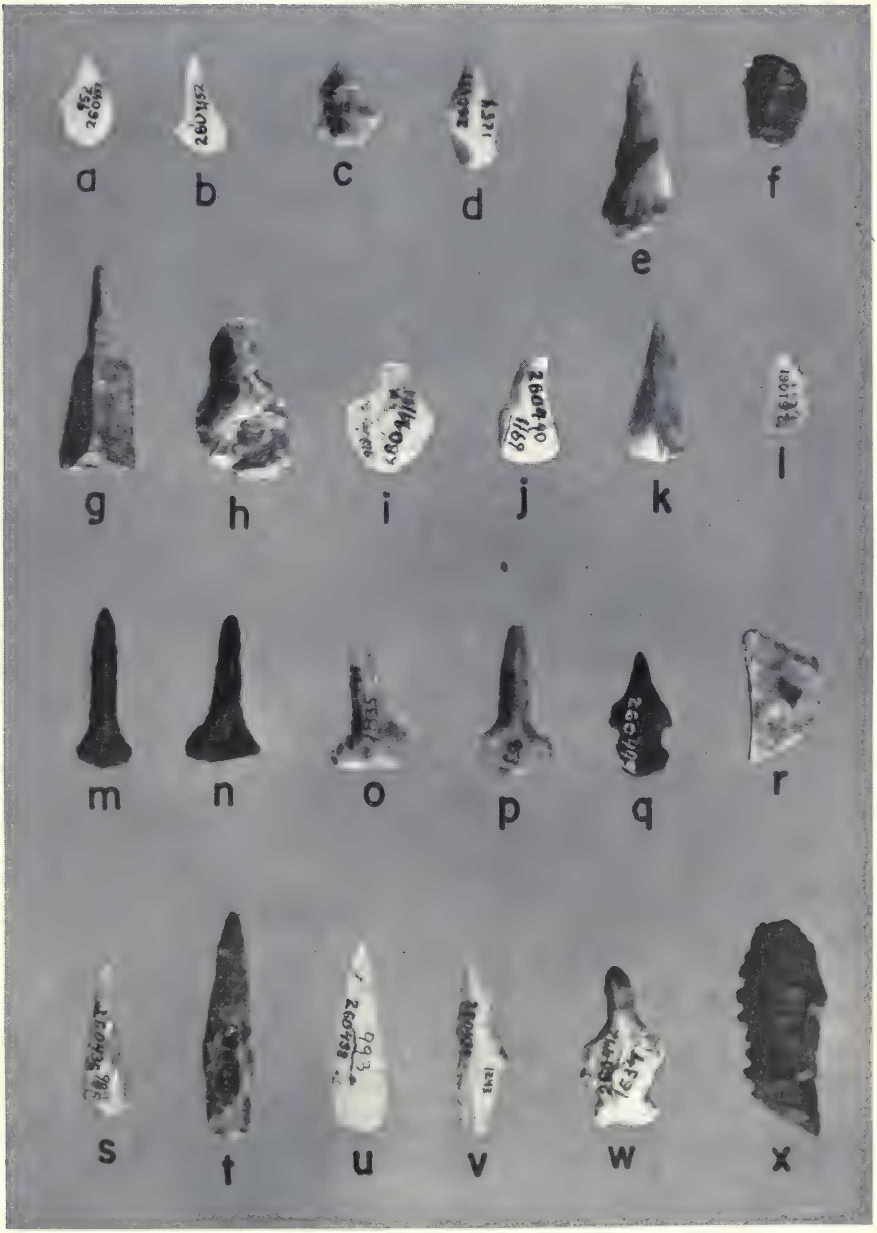
Occurrence by phases, Cordova Cave:
Pre-Pottery, 2
Length, 4.3, 4.8 cm.; width, 2.2, 3.1 cm.; thickness, 0.6, 1.1 cm.
Materials: Fine-grained basalt, trachyte

(d) Reworked lateral notched projectile points (Fig. 60, *q*, *w*) 6

Occurrence by phases, Tularosa Cave:
Pre-Pottery, 2
Georgetown, 1
Occurrence by phases, Cordova Cave:
Pre-Pottery, 1
Plain Ware, 1
Late, 1
Length: 4.4, 3.4, 2.4, 3.0, 3.2, 6.2 cm.
Width: 2.4, 1.7, 1.6, 2.6, 1.4, 1.9 cm.
Thickness: 0.5, 0.6, 0.4, 0.7, 0.5, 0.7 cm.
Materials: Chert, fine-grained basalt, obsidian

(e) Shaft fragments 21

Occurrence by phases, Tularosa Cave:
Pre-Pottery, 2
Pine Lawn-through-Georgetown, 1
San Francisco, 2
Occurrence by phases, Cordova Cave:
Pre-Pottery, 9
Plain Ware, 2
Late, 5
Width: 1.1–2.2 cm.; average, 1.5 cm.
Thickness: 0.4–1.1 cm.; average, 0.7 cm.
Materials: Chert, fine-grained basalt, chalcedony, obsidian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x

FIG. 60. Drills (*a–e*, *g–k*, *m–q*, *s–w*) and saws (*f*, *l*, *r*, *x*). Length of *x*, 6.1 cm.

Gravers

(Figure 49, *q–t*)

Bulky flakes with short points, chipped from one face only................ 11

Occurrence by phases, Cordova Cave:
  Pre-Pottery, 3
  Plain Ware, 3
  Late, 5
Length: 2.0–5.3 cm.; average, 3.7 cm.
Width: 1.5–4.2 cm.; average, 2.6 cm.
Thickness: 0.3–1.0 cm.; average, 0.7 cm.
Materials: Chert, fine-grained basalt

Saws

(Figure 60, *f*, *l*, *r*, *x*)

Thin flakes, plano-convex in cross section; edges deeply indented, serrate.. 4

Occurrence by phases, Tularosa Cave:
  San Francisco, 3
  San Francisco-through-Tularosa, 1
Length: 3.7, 6.1, 2.6, 2.2 cm.
Width: 2.0, 2.6, 1.8, 1.2 cm.
Thickness: 0.7, 0.9, 0.6, 0.3 cm.
Materials: Jasper, chalcedony, obsidian

Hoes

(Not illustrated)

Thin plates of stone roughly long triangular in outline; chipped along edges. 5

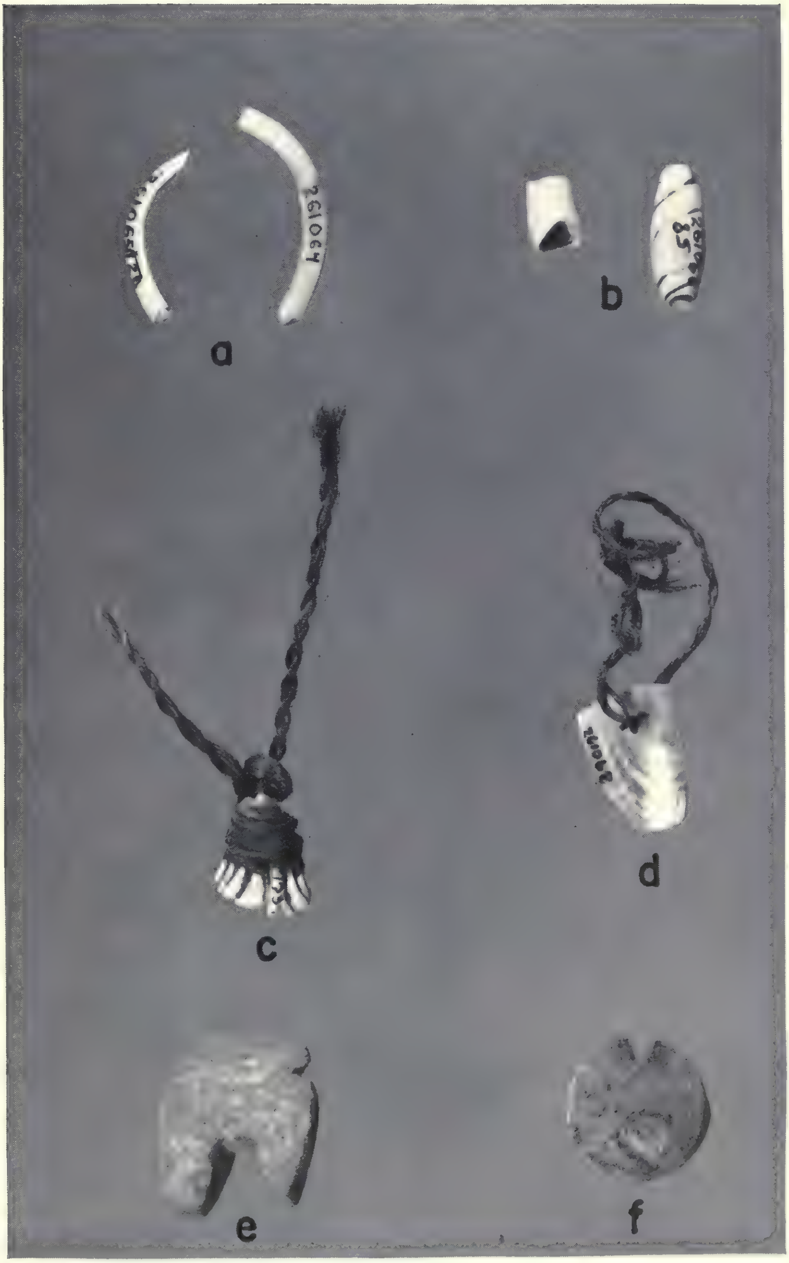
Occurrence by phases, Tularosa Cave:
  San Francisco, 1
  San Francisco-through-Tularosa, 2
  Reserve-through-Tularosa, 2
All were fragments

Atlatl Charms(?)

(Figure 44)

Small, close-grained gray stones; oval in outline, lenticular in cross section; one shows trace of binding.. 5

Occurrence by phases, Tularosa Cave:
  Pre-Pottery, 1
  Pine Lawn, 1
  Georgetown, 2
  San Francisco, 1
Length: 3.1, 4.8, 2.4, 3.6, 5.2 cm.
Width: 1.2, 2.2, 1.7, 1.7, 1.5 cm.
Thickness: 0.7, 0.7, 0.9, 0.9, 0.7 cm.
Material: Chalcedony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a
b
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d
e
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FIG. 61. Bracelet fragments (*a*), beads (*b*), and pendants (*c–f*). Diameter of *f*, 3.1 cm.

Stone Pendants

(Figures 44, 61, *e*, *f*,)

(a) Conical stone, deep groove around middle, bound with sinew (Fig. 44) . . 1
From Georgetown Phase, Tularosa Cave, 1
Length, 3.0 cm.; diameter, 2.4 cm.
Material: Chalcedony

(b) Forked object, trapezoidal in outline; deep groove around top (Fig. 61, *e*). 1
From San Francisco-through-Tularosa phases, Tularosa Cave, 1
Length, 3.9 cm.; width, 3.3 cm.; thickness, 1.4 cm.
Material: Sandstone

(c) Thin disk with hole drilled through near margin (Fig. 61, *f*) 1
From San Francisco-through-Tularosa phases, Tularosa Cave, 1
Diameter, 3.1 cm.; thickness, 0.5 cm.
Material: Limestone

(d) Polished black tabular object; roughly trapezoidal in outline (not illustrated) 1
From Georgetown Phase, Tularosa Cave, 1
Length (fragment); width, 1.5 cm.; thickness, 0.4 cm.
Material: Lignite

Bracelets

(Figure 61, *a*)

(a) Thin cut curved sections of bivalve shell, rectangular in cross section and slightly higher than wide 2
From San Francisco-through-Tularosa phases, Tularosa Cave, 2
Diameter (fragments); height, 0.5, 0.5 cm.; width, 0.1, 0.3 cm.
Material: *Glycymeris* shell

(b) Beak or umbo fragment of thick shell bracelet, umbo perforated(?) 1
From Pre-Pottery Phase, Cordova Cave, 1
Diameter (fragment); height, 1.2 cm.; width, 1.1 cm.
Diameter of suspension hole: 0.1 cm.
Material: *Glycymeris* shell

Beads

(Figure 61, *b*)

(a) Small shells with spire cut off so that string could be passed through . . . 2
From San Francisco-through-Tularosa phases, Tularosa Cave, 1
From Late Phase, Cordova Cave, 1
Length, 2.9, 1.2 cm.; width, 1.2, 0.6 cm.; thickness, 1.0, 0.6 cm.
Material: *Olividae* shell

(b) Curved tubular shell bead, surface polished smooth 1
From Georgetown Phase, Tularosa Cave, 1
Length, 1.5 cm.; diameter, 1.1 cm.
Material: *Vermetus*(?) shell

Shell Pendant

(Figure 61, *d*)

Keystone-shaped section of thin iridescent bivalve shell perforated near broad end; has small two-strand cord as string 1
From Georgetown Phase, Tularosa Cave, 1
Length, 3.0 cm.; width, 2.1 cm.; thickness, 0.1 cm.
Material: Fresh-water clam shell

Bone Awls

(Figure 62)

(a) Head of bone intact, other end ground and polished to a point (Fig. 62, *a, e, g, h*) 10

Occurrence by phases, Tularosa Cave:
Pine Lawn, 3
Georgetown, 1
San Francisco, 2
San Francisco-through-Tularosa, 3
Occurrence by phases, Cordova Cave:
Pre-Pottery, 1
Length: 5.6–13.3 cm.; average, 9.1 cm.
Material: Deer (*Odocoileus*) ulnas

(b) Head of bone unworked by original splitting; other end ground and polished to a sharp point; made from longbones split in half; two specimens with side notch (Fig. 62, *i–l*) 8

Occurrence by phases, Tularosa Cave:
Pre-Pottery, 1
Georgetown, 2
Occurrence by phases, Cordova Cave:
Plain Ware, 1
Late, 4
Length: 4.3, 6.5, 22.5, 8.5, 7.3 cm. (remainder fragments)
Material: Deer (*Odocoileus*) metacarpals

(c) Head of bone entirely worked down; other end ground and polished to a point; made from longbone split in half (Fig. 62, *n–p*) 2

Occurrence by phases, Tularosa Cave:
Georgetown, 1
San Francisco, 1
Length: 10.0, 13.4 cm.

Bone Awls—*continued*

(Figure 62)

(d) Splinters of longbone with one end ground and polished to a point (Fig. 62, *q–w*) 18

Occurrence by phases, Tularosa Cave:
Pre-Pottery, 2
Pine Lawn, 1
Georgetown, 6
San Francisco, 5

Occurrence by phases, Cordova Cave:
Pre-Pottery, 1
Late, 3

Length: 5.2–12.8 cm.; average, 8.9 cm.

(e) Section of split longbone; part of articular surface bound with fiber to make a knob handle; other end ground and polished to a point (Fig. 62, *m*) 1

Occurrence by phases, Tularosa Cave:
Pre-Pottery, 1

Length: 13.9 cm.

(f) Points or tips of awls, all fragments 20

Occurrence by phases, Cordova Cave:
Pre-Pottery, 4
Plain Ware, 1
Late, 15

Length: All fragments

(g) Splinter of scapula with one end ground and polished to a point (Fig. 62, *f*) . 1

Occurrence by phases, Tularosa Cave:
Pre-Pottery, 1

Length: 9.5 cm.

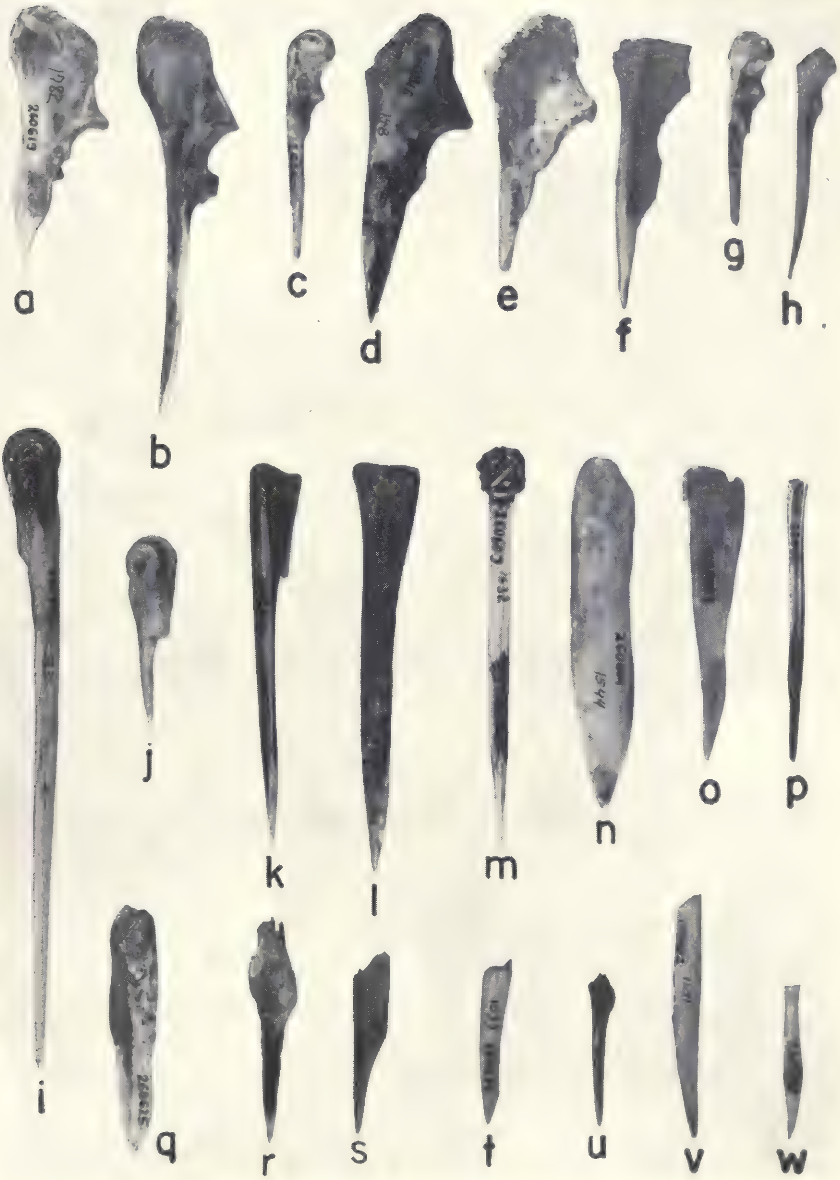
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FIG. 62. Bone awls. Length of *w*, 5.5 cm.

Bone Punches or Knives

(Figure 63, *e, g, k, m*)

Rib and longbone fragments with knife-like edges and tips ground and polished to blunt points; the two longbone specimens have the articular surfaces left intact........ 4

Occurrence by phases, Tularosa Cave:
Georgetown, 2
San Francisco, 2

Length: 11.6, 6.1, 11.6, 7.8 cm.

Materials: Mammal ribs, antelope (*Antilocapra*) ulna

Bone Fleshers or End Scrapers

(Figure 63, *d, f, h, j, l*)

(a) Portions of split longbones with one flat surface and one beveled end... 5

Occurrence by phases, Tularosa Cave:
Pre-Pottery, 2
Pine Lawn, 1
Georgetown, 1
Unplaced, 1

Length: 13.4, 7.6, 11.1, 11.9, 8.8 cm.

(b) Thin concave, or half-tube section of longbone with one end smooth, polished and beveled, the other end broken; the outer surface scratched lengthwise, particularly at polished end........ 1

Occurrence by phases, Cordova Cave:
Late, 1

Length, 6.7 cm.; width, 2.0 cm.; thickness, 0.2 cm.

Bone Flakers

(Figure 63, *b*)

Short oblong tools, rectangular in cross section, with beveled blunted ends; end of one specimen charred........ 3

Occurrence by phases, Tularosa Cave:
Georgetown, 1

Occurrence by phases, Cordova Cave:
Plain Ware, 1
Late, 1

Length, 6.5, 5.7, 5.2 cm.; width, 1.1, 1.2, 1.2 cm.; thickness, 0.9, 0.7, 0.7 cm.

Weaving Tools(?)

(Figure 63, *a*)

Fragments of longbones split in half with one end cut off square and then slightly beveled; edges carefully worked........ 2

Occurrence by phases, Tularosa Cave:
Georgetown, 1
Reserve-through-Tularosa, 1

Length, 10.6, 17.3 cm.; width, 0.8, 1.4 cm.; thickness, 0.8, 1.4 cm.

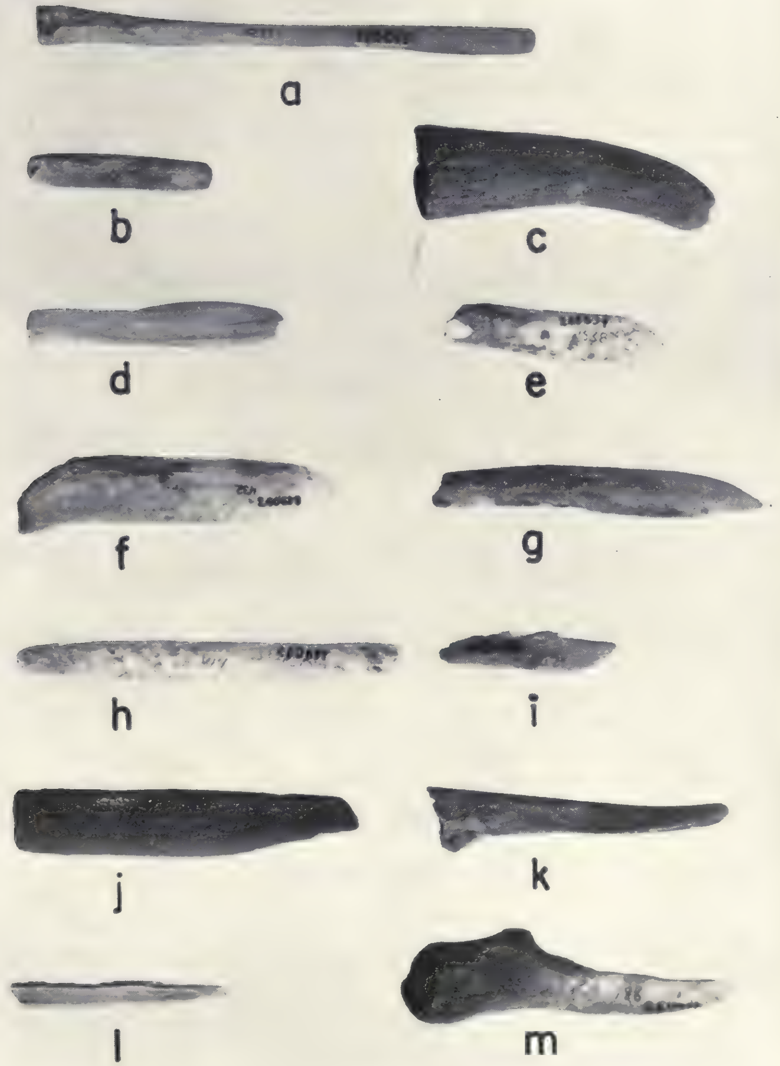
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FIG. 63. Weaving tool (*a*), flaker (*b*), antler cup (*c*), end scrapers (*d, f, h, j, l*), punches (*e, g, k, m*), and knife (*i*). Length of *m*, 11.6 cm.

Tubes

(Figure 64)

Short hollow sections of longbone shafts, with ends cut and polished smooth. 12

Occurrence by phases, Tularosa Cave:
  Pine Lawn, 1
  San Francisco, 1
  San Francisco-through-Tularosa, 3
Occurrence by phases, Cordova Cave:
  Pre-Pottery, 3
  Plain Ware, 2
  Late, 2
Length: 1.1–7.9 cm.; average, 3.7 cm.
Diameter: 0.5–1.2 cm.; average, 0.9 cm.

Dice

(Figure 64)

Oblong slips of bone with curved edges having one surface smooth and the other scratched across; two specimens with cancellous portion of bone removed to form groove.......... 10

Occurrence by phases, Tularosa Cave:
  Pre-Pottery, 1
  Pine Lawn, 1
  Georgetown, 1
  San Francisco, 1
  San Francisco-through-Tularosa, 1
Occurrence by phases, Cordova Cave:
  Pre-Pottery, 1
  Plain Ware, 1
  Late, 3
Length: 2.0–4.3 cm.; average, 3.0 cm.
Width: 1.0–1.9 cm.; average, 1.2 cm.
Thickness: 0.2–0.5 cm.; average, 0.4 cm.

Bone Pendants

(Figures 61, *c*, 65, *h*)

(a) Two deer incisors bound at the root with sinew; a two-ply cord passes through the sinew binding and is knotted just above the teeth (Fig. 61, *c*) 1

  Occurrence by phases, Tularosa Cave:
    Georgetown, 1
  Length: 10.7 cm.; width, 2.0 cm.; thickness, 1.1 cm.

(b) Small rectangular fragment of bone, worked smooth along edges; four grooved notches in thinner edge; hole drilled through one end (Fig. 65, *h*).......... 1

  Occurrence by phases, Cordova Cave:
    Plain Ware, 1
  Length, 2.5 cm.; width, 1.1 cm.; thickness, 0.4 cm.

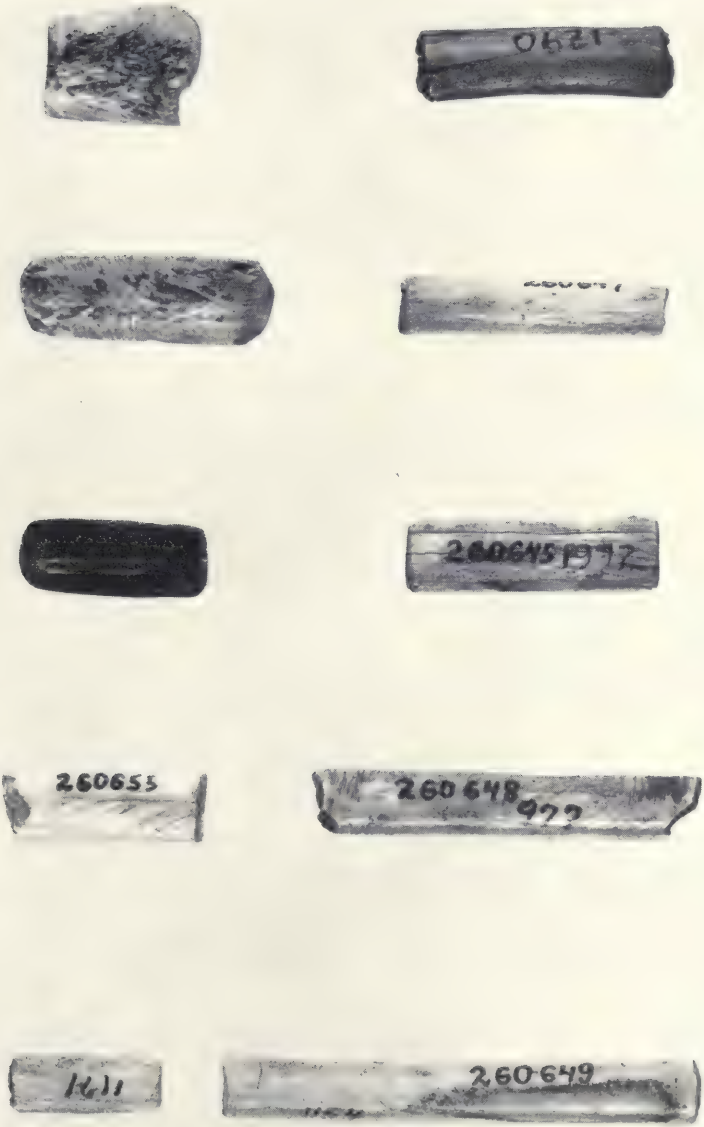
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FIG. 64. Dice (left column) and tubes (right column). Length of right specimen (bottom row), 7.9 cm.

Notched Ribs

(Figure 65, *b–d*)

Animal ribs with smooth rounded notches worn in thin edges.............. 3

Occurrence by phases, Cordova Cave:
  Pre-Pottery, 1
  Plain Ware, 2

Length, 7.8, 3.8, 9.1 cm.; width, 2.7, 1.3, 1.3 cm.; thickness, 1.0, 0.7, 0.7 cm.

Dart Bunt

(Figure 65, *e*)

Head of longbone cut off at right angles to shaft, remainder of shaft below head hollowed out to receive dart foreshaft............................. 1

Occurrence by phases, Cordova Cave:
  Late, 1

Length, 5.2 cm.; width, 3.5 cm.; thickness, 2.1 cm.
Material: Mammal legbone

Antler Flakers

(Figure 65, *i*)

Ends of antler tines with beveled tips that show use as flakers............. 3

Occurrence by phases, Cordova Cave:
  Plain Ware, 1
  Late, 2

Length, 3.3, 7.7, 8.0 cm.; width, 1.5, 1.3, 2.0 cm.; thickness, 0.9, 1.2, 1.3 cm.
Material: Deer (*Odocoileus*) antler

Antler Rubbers or Hammers

(Figure 65, *f*, *g*)

Section of antler, one end of which is slightly beveled and polished or worn.. 3

Occurrence by phases, Cordova Cave:
  Pre-Pottery, 2
  Late, 1

Length, 3.1, 3.7, 4.7 cm.; width, 2.4, 2.3, 2.3 cm.; thickness, 2.1, 1.9, 2.0 cm.
Material: Deer (*Odocoileus*) antler

Antler Cup

(Figure 63, *c*)

Tip of antler hollowed out to form a deep cup; a hole has been drilled up into the exterior of the bottom end toward the cup........................ 1

Occurrence by phases, Tularosa Cave:
  Georgetown, 1

Length, 10.8 cm.; width, 3.4 cm.; thickness, 2.6 cm.
Material: Antler

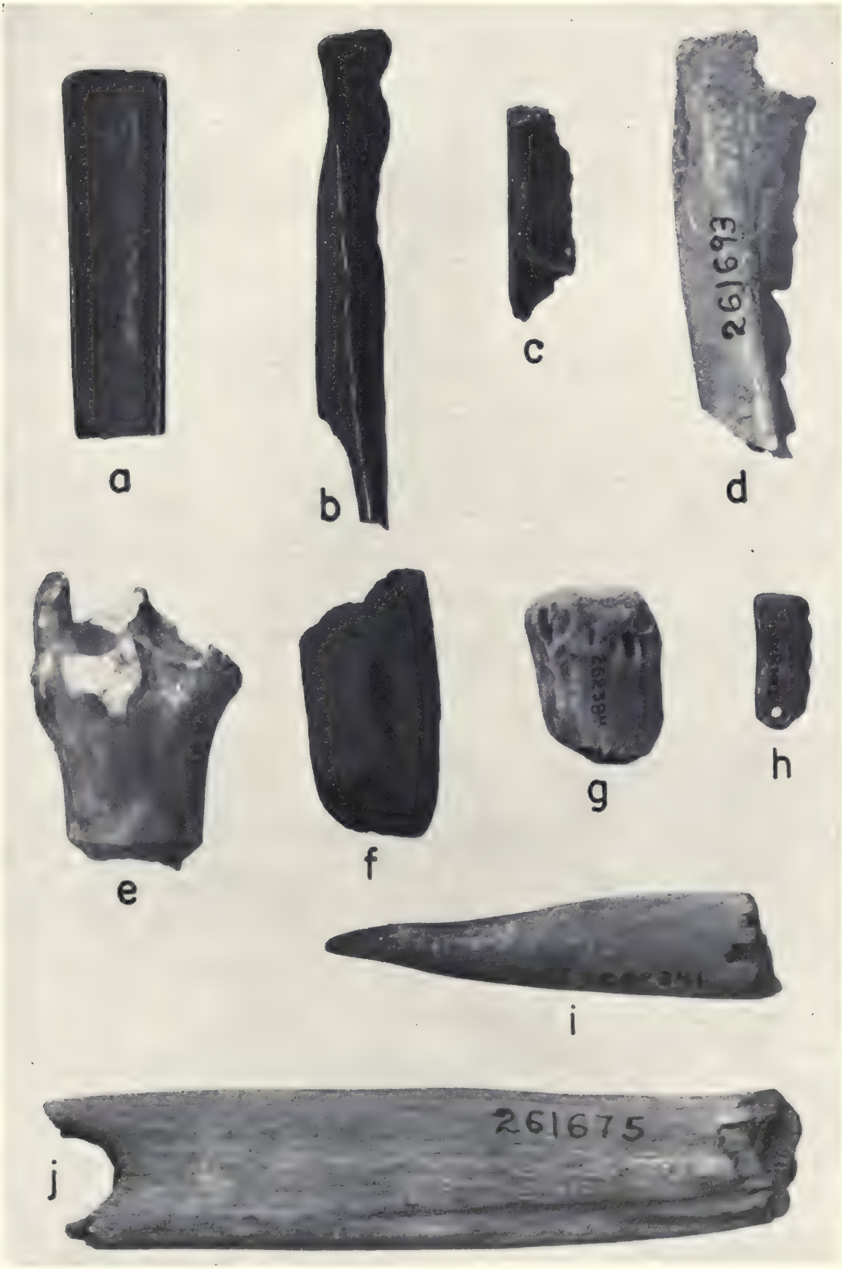
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FIG. 65. End scraper (*a*), notched ribs (*b–d*), bunt (*e*), antler hammers (*f*, *g*), pendant (*h*), flaker (*i*), and wrench (*j*). Length of *j*, 12.7 cm.

Wrench

(Figure 65, *j*)

Long section of antler with large hole in one end........................ 1
Occurrence by phases, Cordova Cave:
  Plain Ware, 1
Length, 12.7 cm.; width, 3.0 cm.; thickness, 1.9 cm.
Diameter of hole: 1.5 cm.
Material: Deer (*Odocoileus*) antler

Worked Sherds

(Figure 66, *k–m*)

(a) Roughly rectangular in outline; three edges ground smooth.............. 3
  Occurrence by phases, Tularosa Cave:
    San Francisco, 1
    San Francisco-through-Tularosa, 1
  Occurrence by phases, Cordova Cave:
    Late, 1
  Length, 5.0, 3.1, 4.7 cm.; width, 2.6, 4.0, 2.7 cm.; thickness, 0.6, 0.4, 0.6 cm.
  Materials: Reserve Smudged, San Francisco Red pottery

(b) Round in outline, edges notched, decorated with spiral design in red and gray, exterior brown, interior gray polished over..................... 1
  Occurrence by phases, Cordova Cave:
    Plain Ware, 1
  Diameter, 3.2 cm.; thickness, 0.6 cm.
  Material: Unknown pottery type

Figurines

(Figure 67, *d–f*)

(a) Rough figure of human torso, head and feet; feet turn up; fiber waist cord tied on left side; torso "hour glass" form; peg in top of head broken off.. 1
  Occurrence by phases, Tularosa Cave:
    Georgetown, 1
  Length, 5.7 cm.; width, 2.2 cm.; thickness, 1.5 cm.

(b) Forked elongate lumps of coarse clay; possibly legs and torsos of figurines, or forked ladle handles.................................. 2
  Occurrence by phases, Tularosa Cave:
    San Francisco, 2
  Length, 5.4, 3.6 cm.; width, 2.6, 2.7 cm.; thickness, 1.8, 1.3 cm.

Animal Effigies

(Figure 67, *a—c*)

Quadruped animal figures, portions of heads, legs, and tails broken off...... 3
Occurrence by phases, Tularosa Cave:
  Georgetown, 2
  San Francisco, 1
Length, 4.5, 5.0, 4.9 cm.; width, 1.9, 2.5, 2.4 cm.; thickness, 1.8, 2.5, 2.3 cm.

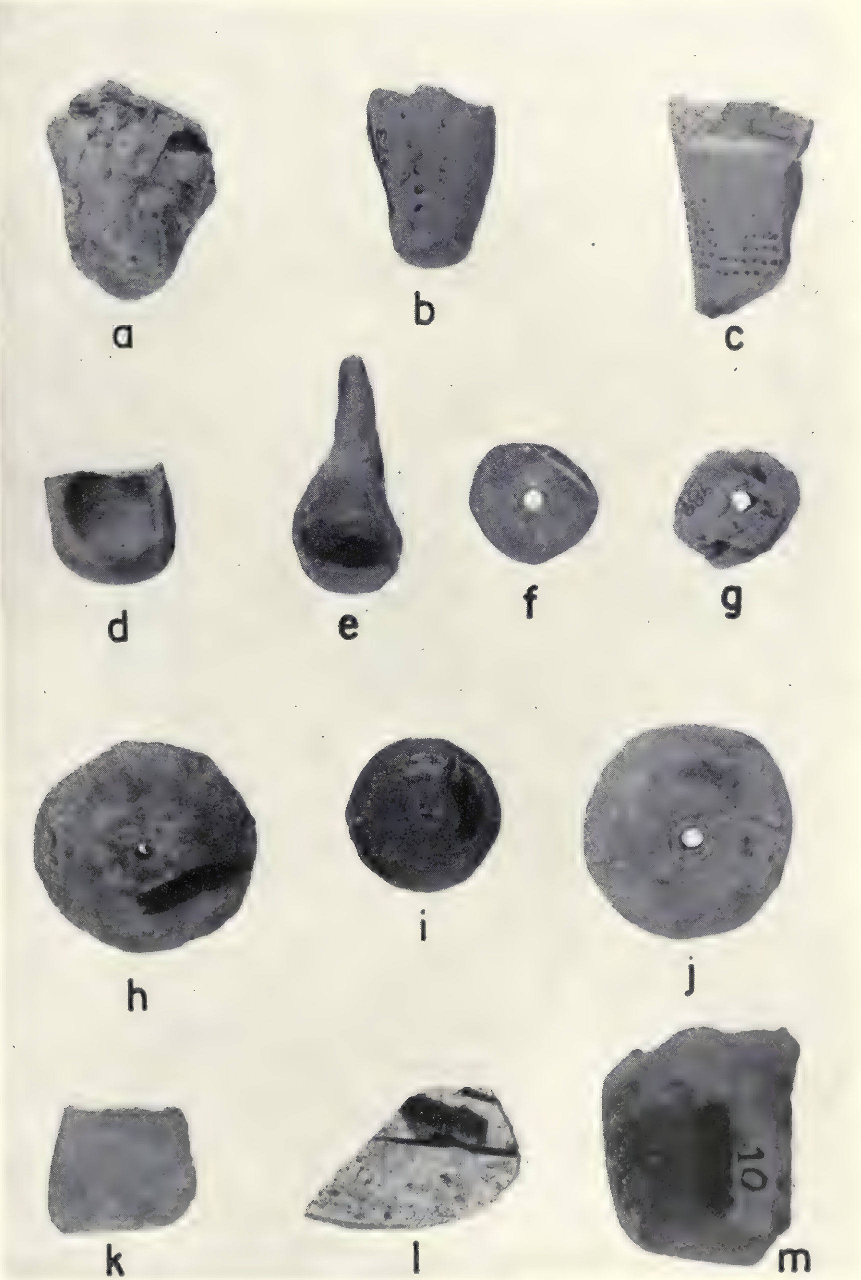
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FIG. 66. Cornucopias (*a–c*), ladles (*d*, *e*), spindle whorls (*f–j*), and worked sherds (*k–m*). Length of *m*, 5.0 cm.

Cornucopias

(Figure 66, *a–c*)

Baked brown clay cornucopia-shaped objects with incised lines and rows of punctate dots in curvilinear designs 3

Occurrence by phases, Tularosa Cave:
San Francisco, 2
San Francisco-through-Tularosa, 1

All fragments about 4 cm. long

Phallic Images

(Figure 67, *g–i*)

Molded pottery phalli; two with differentiated *glans penis* 3

Occurrence by phases, Tularosa Cave:
Georgetown, 1
San Francisco-through-Tularosa, 1
Reserve-through-Tularosa, 1

Length, 6.1, 7.1, 7.4 cm.; width, 4.5, 3.5, 2.3 cm.; thickness, 2.0, 2.9, 1.6 cm.

Spindle Whorls

(Figure 66, *f–j*)

Roughly circular molded pottery objects with a hole perforated through the center; fragments of spindle sticks remain in holes of two specimens 5

Occurrence by phases, Tularosa Cave:
Georgetown, 3
San Francisco, cave floor, 1
San Francisco, 1

Diameter: 2.7, 4.6, 4.7, 3.1, 2.5 cm.

Thickness: 0.6, 1.0, 1.5, 1.2, 1.2 cm.

Miniature Ladles

(Figure 66, *d, e*)

Bowl portion roughly round, deep (1.2 cm.); handles rod-like, tapering from bowl end to tip 2

Occurrence by phases, Tularosa Cave:
San Francisco-through-Tularosa, 2

Length, 5.0 cm., one fragment; width, 2.2, 2.6 cm.; height, 2.0, 2.0 cm.

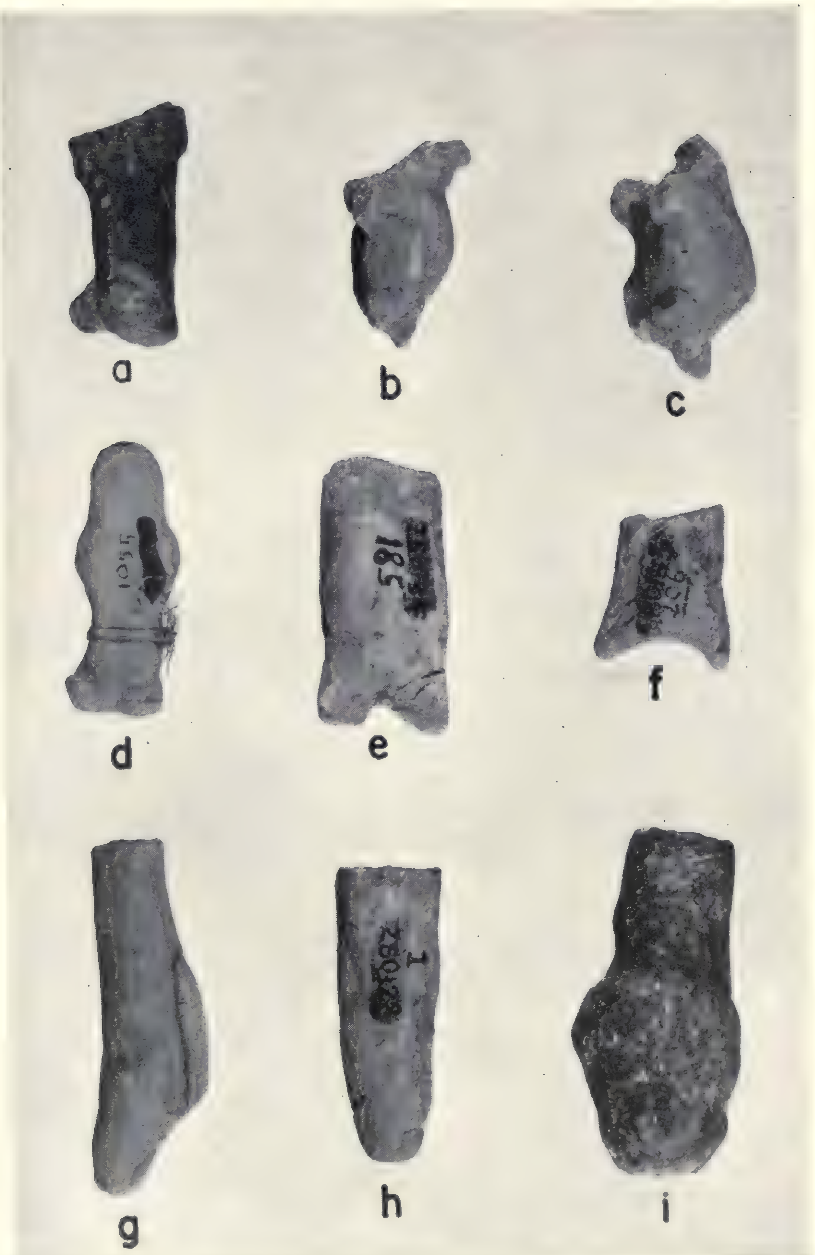
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FIG. 67. Animal effigies (*a–c*), figurines (*d–f*), and phallic images (*g–i*). Length of *i*, 7.1 cm.

Pot or Basket Covers

(Figure 68)

Large thick circular lumps of unfired clay coarsely tempered with fiber and pebbles; impressions of pot or basket and lining materials on bottom surfaces. 4
Occurrence by phases, Tularosa Cave:
  Pre-Pottery, 1
  Pine Lawn, 1
  Georgetown, 2
Diameter, 10.4, 11.3, 11.2, 5.6 cm.; thickness, 2.4, 4.2, 2.3, 2.2 cm.

Clay Balls

Small round pellets of clay 3
Occurrence by phases, Cordova Cave:
  Pre-Pottery, 1
  Plain Ware, 1
  Late, 1
Diameter, 2.7, 1.7, 1.9 cm.

Pigments

(a) Red lumps of pigment (hematite) 11
  Occurrence by phases, Tularosa Cave:
    Pre-Pottery, 2
    Pine Lawn, 1
    Georgetown, 2
    San Francisco, 1
  Occurrence by phases, Cordova Cave:
    Pre-Pottery, 2
    Late, 3

(b) Green lumps of pigment (malachite) 5
  Occurrence by phases, Tularosa Cave:
    Pre-Pottery, 1
    San Francisco, 2
    San Francisco-through-Tularosa, 2

(c) Blue lump of pigment (malachite) 1
  Occurrence by phases, Tularosa Cave:
    San Francisco-through-Tularosa, 1

(d) Yellow lumps of pigment (limonite) 2
  Occurrence by phases, Tularosa Cave:
    Pre-Pottery, 1
    Pine Lawn, 1

Quartz Crystals

Sharp hexagonal crystals, possibly drills 2
Occurrence by phases, Tularosa Cave:
  Pre-Pottery, 1
Occurrence by phases, Cordova Cave:
  Pre-Pottery, 1
Lengths, 3.1, 3.8 cm.; widths, 1.6, 2.4 cm.; thicknesses, 1.2, 1.8 cm.

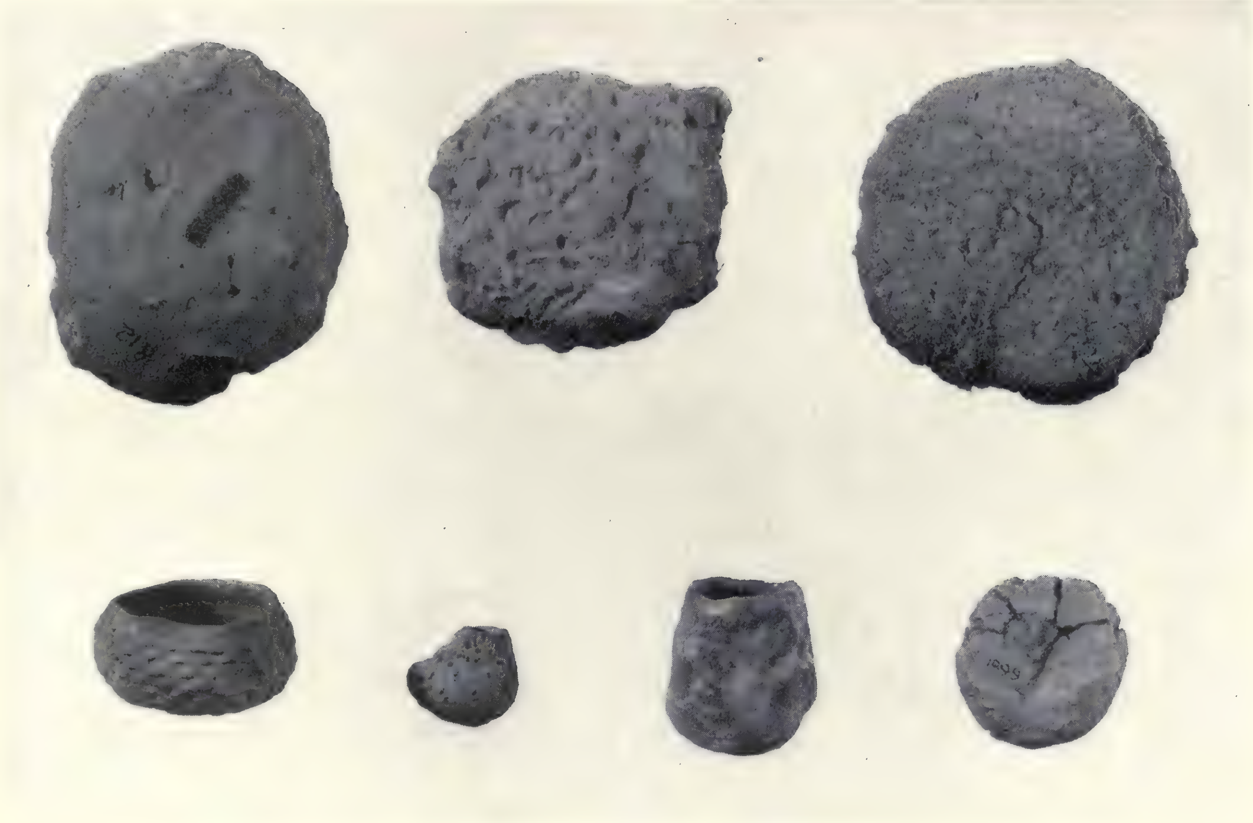
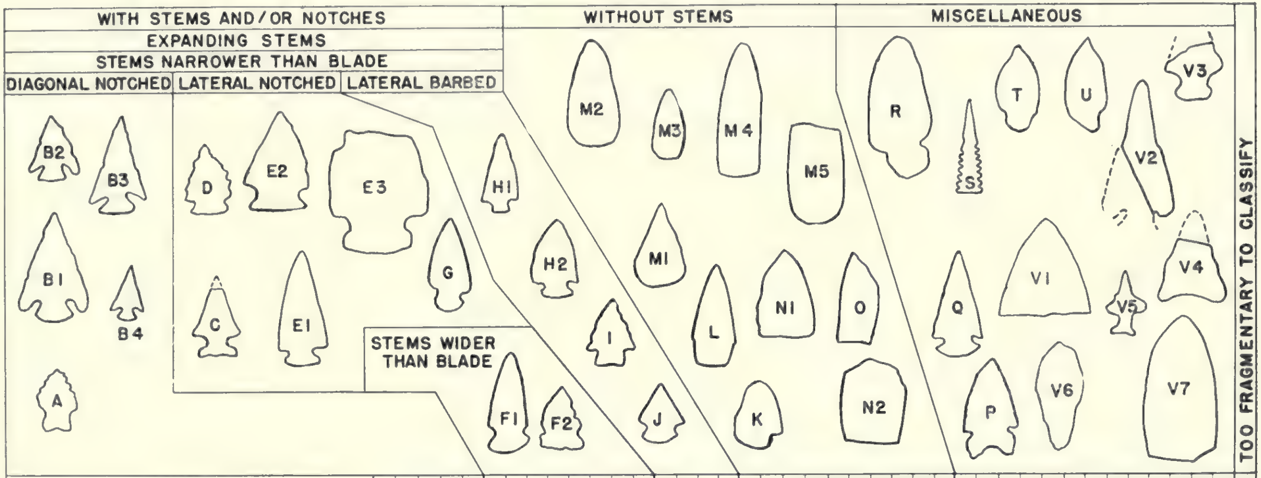


FIG. 68. Pot or basket covers and miniature vessels. Diameter of right specimen (bottom row), 5.6 cm.

ARTIFACTS		MANOS														RUBBING STONES																						
		WITH SINGLE GRINDING SURFACES							WITH TWO GRINDING SURFACES							WITH SINGLE RUBBING SURFACES				WITH TWO RUBBING SURFACES																		
PHASES		OVAL, CONVEX	OVAL, SLIGHTLY CONVEX	OVAL, FLAT	ROUND, FLAT	ROUND, FLAT (FRAGMENTS)	RECTANGULAR, SLIGHTLY CONVEX	RECTANGULAR, FLAT	ROUND, CONVEX	ROUND, SLIGHTLY CONVEX	ROUND, ONE FLAT ONE CONVEX	ROUND, FLAT	RECTANGULAR, SLIGHTLY CONVEX	RECTANGULAR, FLAT	RECTANGULAR, BEVELED	OVAL, CONVEX	OVAL, SLIGHTLY CONVEX	OVAL, FLAT	IRREGULAR, FLAT	OVAL, FLAT	ROUND, ONE FLAT, ONE SLIGHTLY CONVEX	RECTANGULAR, FLAT	POLISHING STONES	PESTLES	SLAB METATES	BASIN METATES	TROUGH METATES (ONE END ONLY OPEN)	METATE FRAGMENTS	SMALL METATE-LIKE GRINDING STONES	PAINT GRINDING STONES	MORTAR (BOULDER TYPE)	WORKED SLABS	HAMMERSTONES	ABRADING STONES	AWL SHARPENERS	STONE BALLS	PIPES	FOOT EFFIGIES
TULAROSA CAVE	MIXED RESERVE-TULAROSA					1						1		2	4		1		5					1								1	3		1			
	MIXED SAN FRANCISCO-TULAROSA					2	2	2				1			5		1		11			4	2							4		1	3		1	2	1	
	SAN FRANCISCO					2	1	1		1		1		2	5		1		7				3	2	2	3	3		1	2			1	2		2		2
	GEORGETOWN								1			2							11			2	5			7	1		2		1		1	3	1	4	1	
	MIXED PINE LAWN-GEORGETOWN																																					
	PINE LAWN			1								1							4				1	1	2	2	1						2		2	2		
	SAN FRANCISCO PHASE CAVE FLOOR																												1									
	PRE-POTTERY			5		1			1		2						1		2				2			3			1	1			1	2		8		
	TOTAL			6		6	3	3	2	1	2	6		4	14		4		40			6	13	4	4	15	5		5	7	1	2	11	7	5	18	2	2
CORDOVA CAVE	LATE	4	3	1	1			8		1	1	1	1			2	1	1	1	1	1		4		1		2	5				1	12				1	
	PLAIN WARE		1	4			1	1				1	2			1		1					3				1						3	1				
	PRE-POTTERY	3	2	1				2	1							2				1					2	3		2					11					
	TOTAL	7	6	6	1		1	11	1	1	1	2	3			5	1	2	1	2	1		7		3	3	3	7				1	26	1			1	
TOTAL		7	6	12	1	6	4	14	3	2	3	8	3	4	14	5	5	2	41	2	1	6	20	4	7	18	8	7	5	7	1	3	37	8	5	18	3	2

FIG. 69. Occurrence of ground and pecked stone artifacts by phases, Tularosa and Cordova caves.


WITH STEMS AND/OR NOTCHES
EXPANDING STEMS
STEMS NARROWER THAN BLADE
DIAGONAL NOTCHED
LATERAL NOTCHED
LATERAL BARBED
STEMS WIDER THAN BLADE
WITHOUT STEMS
MISCELLANEOUS
TOO FRAGMENTARY TO CLASSIFY
B2
B3
B1
B4
A
D
E2
E3
C
E1
G
H1
H2
I
F1
F2
J
M2
M3
M4
M5
M1
L
N1
O
K
N2
R
S
T
U
V2
V3
Q
V1
V5
V4
P
V6
V7

	PHASES	A	B1	B2	B3	B4	C	D	E1	E2	E3	F1	F2	G	H1	H2	I	J	K	L	M1	M2	M3	M4	M5	N1	N2	O	P	Q	R	S	T	U	V1	V2	V3	V4	V5	V6	V7	W
TULAROSA CAVE	MIXED RESERVE-TULAROSA			1																	1																1					
	MIXED SAN FRANCISCO-TULAROSA		7	6		4						1		1	1		2				8	2	3				1		1					1								3
	SAN FRANCISCO		2	7	1	4	1	3				2		9	2		2		2		10	5	1		2	2	3															6
	GEORGETOWN		2	7	4	1	2		5			3		4	2			3		2	7	5	1		20	4		7							1				1			9
	MIXED PINE LAWN-GEORGETOWN																																									
	PINE LAWN	2		5	3		2	2						5	2		1	4	2	1	7	1			8		1	2														9
	SAN FRANCISCO PHASE CAVE FLOOR	1	1	4			2		2			3					1				2				1																	
	PRE-POTTERY	2	5	11	2		3	1	1					3	2		1	3			8	7	1		18		3	4								2		1				18
	TOTAL	5	17	41	10	9	10	6	8			9		22	9		7	10	4	3	43	20	6		49	6	8	13	1					1	1	2	1	1	1			45
CORDOVA CAVE	LATE		2	10		6	3			10	2	5	3	2	2	2					5	2		2	11	3	4	5	6	1	2	3	2									19
	PLAIN WARE		1	4		4		2	4	8		2		2	4	1				2	3	4	2	1	9	2	6	2	2	1	1	1								1		19
	PRE-POTTERY	2	1	12	1	4	3	9	3	12	2			9	1	12	3	1		2	5		3	6	28		9	8	2	1	1			4							1	38
	TOTAL	2	4	26	1	14	6	11	7	30	4	7	3	13	7	15	3	1		4	13	6	5	9	48	5	19	15	10	3	4	4	2	4						1	1	76
	TOTAL BOTH CAVES	7	21	67	11	23	16	17	15	30	4	16	3	35	16	15	10	11	4	7	56	26	11	9	97	11	27	28	11	3	4	4	2	5	1	2	1	1	1	1	1	121

FIG. 70. Occurrence of projectile points and blades by phases, Tularosa and Cordova caves.

ARTIFACTS		SCRAPERS										DISCOIDALS	CHOPPERS				DRILLS								GRAVERS	SAWS	HOES	ATLATL CHARM STONES	PENDANTS, STONE	SHELL ARTIFACTS				
		SIDE SCRAPERS							HOLLOW EDGE SCRAPERS	END SCRAPERS																								
PHASES		RANDOM THICK FLAKE	LARGE ROUGH THICK	SMALL ROUGH THICK	SMALL THIN FLAKE	SERRATE NODULE	KEELED	BIFACE		OVAL	SQUARISH		SCRAPER PLANES-UNIFACE	UNIFACE PEBBLE	BIFACE	BIFACE PEBBLE	SHARPENED FLAKES	BROAD BASE SHARPENED FLAKES	PLAIN SHAFTED	SMALL ABRUPTLY WIDENING FLANGE	SLENDER POINTS BROAD BASE	WING BASE	REWORKED PROJECTILE POINTS	SHAFT FRAGMENTS						BRACELETS, THIN	BRACELETS, MEDIUM	BEADS, OLIVELLA	BEADS, VERMETUS	PENDANTS
TULAROSA CAVE	MIXED RESERVE-TULAROSA	3		1	2						1				6			1									2							
	MIXED SAN FRANCISCO-TULAROSA	12	11	12	6		2	10	1		3		2		14		2		1	1						1	2		2	2		1		
	SAN FRANCISCO	31	18	9	11		1	8	2	1			1	3	22	6					2			2		3	1	1						
	GEORGETOWN	28	23	10	10	1	4	21	1	6			2	2	15	4	2	1	2	1			1					2	2				1	1
	MIXED PINE LAWN-GEORGETOWN		2	1				2							3		1				3			1										
	PINE LAWN	22	25	5	4	1	1	9					1		8	3			2	1								1						
	SAN FRANCISCO PHASE CAVE FLOOR	2	1					1					1		2	1																		
	PRE-POTTERY	27	16	10	3			15		2	3		1	1	12	5		1	1	2			2	2				1						
	TOTAL	125	96	48	36	2	8	66	4	9	7		8	6	82	19	5	3	6	5	5		3	5		4	5	5	4	2		1	1	1
CORDOVA CAVE	LATE	49	19	14	7	2	2	11	1	2	2	2	34		22				1				1	5	5							1		
	PLAIN WARE	67	13	5	5	2	1	11		1	1		20		6					1	1		1	2	3									
	PRE-POTTERY	75	16	20	15	4	2	16	7	7	3	2	17		3		1		1	2	2	2	1	9	3						1			
	TOTAL	191	48	39	27	8	5	38	8	10	6	4	71		31		1		2	3	3	2	3	16	11						1	1		
	TOTAL BOTH CAVES	316	144	87	63	10	13	104	12	19	13	4	79	6	113	19	6	3	8	8	8	2	6	21	11	4	5	5	4	2	1	2	1	1

FIG. 71. Occurrence of shell and chipped stone artifacts by phases, Tularosa and Cordova caves.

	ARTIFACTS	BONE AWLS								FLESHERS														WORKED SHERDS		FIGURINES										
	PHASES	HEAD OF BONE INTACT	INTACT EXCEPT FOR SPLITTING	ENTIRELY WORKED DOWN	SPLINTERS	KNOB HANDLE	POINT FRAGMENTS	SCAPULA	PUNCHES OR KNIVES	FLAT	CONCAVE	FLAKERS	WEAVING TOOLS	TUBES	DICE	NOTCHED PENDANTS	DEER TOOTH PENDANTS	NOTCHED RIBS	DART BUNTS	ANTLER FLAKERS	ANTLER RUBBERS	ANTLER CUPS	WRENCHES	RECTANGULAR	DISC	FULL FIGURE	FORKED LOWER TORSO	ANIMAL EFFIGIES	CORNUCOPIA	PHALLIC IMAGES	SPINDLE WHORLS	MINIATURE LADLES	POT OR BASKET COVERS	CLAY BALLS	PIGMENTS	CRYSTALS
TULAROSA CAVE	MIXED RESERVE-TULAROSA												1																	1						
	MIXED SAN FRANCISCO-TULAROSA	3									1	1		3	1									1					1	1		2				
	SAN FRANCISCO	2		1	5				2					1	1									1			2	1	2		1				1	
	GEORGETOWN	1	2	1	6				2	1		1	1		1		1					1				1		2		1	1		2		2	
	MIXED PINE LAWN-GEORGETOWN																																			
	PINE LAWN	3			1					1		1		1	1																		1		1	
	SAN FRANCISCO PHASE CAVE FLOOR																														1					
	PRE-POTTERY		1		2	1		1		2					1																		1		2	1
	TOTAL	9	3	2	14	1		1	4	4	1	3	2	5	5		1					1		2		1	2	3	3	3	3	2	4		6	1
CORDOVA CAVE	LATE		4		3		15							2	3				1	2	1			1										1	3	
	PLAIN WARE		1				1							2	1	1		2		1			1		1									1		
	PRE-POTTERY	1			1		4							3	1			1			2													1	2	1
	TOTAL	1	5		4		20							7	5	1		3	1	3	3		1	1	1									3	5	1
	TOTAL BOTH CAVES	10	8	2	18	1	20	1	4	4	1	3	2	12	10	1		3	1	3	3	1	1	3	1	1	2	3	3	3	3	2	4	3	11	2

FIG. 72. Occurrence of bone and baked clay artifacts by phases, Tularosa and Cordova caves.

	SQ.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
PRONGHORN ANTELOPE (ANTILOCAPRA)	4L1		3												
	6R1				12	6	3	1							
	2R2					1				6	9		8		3
	3R2	2					7	6	6	16	7	6			
ANTELOPE OR DEER	6R1			32	35	15	10	6							
	3R2				8	11	65	88	54	65	82	81			
BADGER (TAXIDEA TAXUS)	3R2				1			1							
BEAR (URSUS)	4L1			1											
	6R1					1									
BISON	4L1			2											
	6R1		6												
	2R2		1		1										
BOBCAT (LYNX BAILEYI)	4L1		1												
	6R1			1	2	1			1						
	2R2									2	1			1	
	3R2								2						
COTTONTAIL RABBIT (SYLVILAGUS)	4L1		5	5	14										
	6R1		1	3	3	5	5	3	1						
	2R2			1		2	2	4	4	1	5			6	2
	3R2	1			1	1	2	4	5	11	9	17			
CRANE (GRUS)	4L1	1													
DEER (ODOCOILEUS)	4L1	59	55	67											
	6R1	13	23	23	50	34	26	15	9						
	2R2	2	7	6	2	8	43	53	59	18	30	15	14	11	3
	3R2	4	17	6	4	15	22	17	24	18	17	13			
FAWN	4L1	1													
	2R2								18	15	5	4		5	
DOG (CANIS FAMILIARIS)	4L1			4											
	2R2						1		1						
DUCK	4L1	1													
	6R1						1								
	3R2							1							
EAGLE (AQUILA)	6R1	1		1											
FOX (VULPES)	3R2							1	2			1			
KIT FOX (VULPES MACROTIS)	6R1		1		2		2								
	2R2	2							1	1	1				1
	3R2			1											
GRAY FOX (UROCYON)	2R2			1											
GOPHER (GEOMYS)	4L1			1											
	6R1			1											
	3R2											1			
POCKET GOPHER (THOMOMYS)	4L1	2													
HAWK (BUTEO)	6R1						1								
	3R2							1							
HUMAN (HOMO)	4L1	1													
	3R2											1			
JACK RABBIT (LEPUS ALLENI)	6R1				2			1							
	2R2	1		1											
RABBIT	4L1		2	1											
	6R1					4	3	1							
	2R2											2	3		1
	3R2						3	2	4	4	6	4			
MUSKRAT (ONDATRA)	4L1	1		2											
	6R1			2	2		2								
	2R2					1					1				
	3R2								1	1	1	1			
MOUNTAIN SHEEP (OVIS CANADENSIS)	4L1		1	1											
OWL (BUBO)	4L1	1													
PORCUPINE (ERETHIZON)	4L1	2													
	6R1			1	1		2								
	2R2					1	1						1		
	3R2				1	2	1	1	1	3	6	2			
PRAIRIE DOG (CYNOMYS)	4L1	1	1	3											
	6R1	1	1	3	1	1	1								
	2R2					1	1	4	3	1					
	3R2	1	1		1		2	4	1	3	3	10			
RAT (RATTUS)	4L1	1													
WOOD RAT (NEOTOMA)	6R1						1	2							
	2R2										1				
	3R2							1							
UNIDENTIFIED RODENT	3R2											3			
GROUND SQUIRREL (OTOSPERMOPHILUS)	2R2								1						
	3R2										1				
ROCK SQUIRREL (CITELLUS)	4L1		1	1											
	2R2	2													
	3R2											1			
SQUIRREL (SCIURUS)	4L1	1													
	3R2							1	1						
STRIPED SKUNK (MEPHITIS)	2R2			1											
	3R2				1										
TURKEY (MELEAGRIS GALLOPAVO)	4L1	2	4												
	6R1	1			4		2								
	2R2		1	1	1			1	4						
	3R2	1	3	4				2	2	1					
WOODCHUCK (MARMOTA)	4L1			1											
WOLF (CANIS NUBILUS)	4L1			1											
	6R1							1							
	2R2					1									
UNIDENTIFIED BIRD	4L1	3	1	3											
	6R1	1					1	1							
	2R2				1				1	1					
	3R2						1		4	2					
UNIDENTIFIED MAMMAL	4L1	4	7	22											
	6R1	2	6				8	12							
	2R2			2			2	10	26	15	1	3	2	1	4
	3R2	7	5	5				4	3	4	8	14			

FIG. 73. Occurrence of unworked animal bones by selected squares and levels, Tularosa Cave.

V. Cordage, Knots, and Cordage Artifacts

By Elaine Bluhm and Roger Grange, Jr.

LIST OF SPECIMENS

	Tularosa Cave	Cordova Cave
Twisted fiber cordage:		
Hard and bast fiber cord	956	114
Cotton cord	43	3
Hair cord	13	1
Fur cord	411	30
Feather cord	148	9
Knots:		
Square knots	1862	382
Granny knots	42	20
Overhand knots	113	50
Half hitches	4	4
Clove hitches	2	...
Lark's heads	1	...
Single bow knots	13	...
Double bow knots	1	...
Braid	27	2
Snares	23	1
Coils	9	4
Toggles	5	...
"Handcuff" carrying loops	12	...
Carrying loop chains	6	...
Carrying nets	6	1
Burden straps	4	...

Discussion

A total of 1,728 fragments of cordage, including cotton, hard and bast fiber, hair yarns and cords, fur cord and feather cord, was obtained from Tularosa and Cordova caves. In addition, there were 2,494 knots, some tied in cords, but most of them tied in narrow strips of yucca leaves; and 68 artifacts of cords or strips of yucca leaves.

Twisted Fiber Cordage

Most of the 1,130 pieces of twisted fiber cordage were made of hard or bast fiber. On the basis of analysis of string from all of Cordova Cave and squares 2R1 and 2R2 of Tularosa Cave, it may be concluded that the use of bast fiber increased as time passed, and the use of hard fiber correspondingly decreased. Cotton cordage, about 4 per cent of the total collection, is more popular in the later period—San Francisco and Reserve-Tularosa phases—than earlier; hair cord remains constant at about 2 per cent.

When any cord is constructed, the usual practice is to twist or spin the yarn one way and the strand the reverse. If a multiple strand cord is being made, the direction is reversed again when the cord is formed. In analyzing cordage from Tularosa and Cordova caves, particular attention was paid to the twist of the yarn, as that was the initial element that was spun.

Several methods of spinning fiber into yarn are known. It is difficult or impossible to tell which method was used to produce a particular yarn without direct evidence of yarn attached to spindles, but concerning spinning methods it is possible to make some inferences based upon historic evidence and the relative proportions of fibers and their twist directions in the cordage collections from Tularosa and Cordova caves.

Underhill (1944, p. 30) states that the Basketmakers, modern Hopi, and eastern Pueblo Indians spun yucca fiber without a spindle, by rolling the fiber down the right thigh with the palm of the right hand. This process would result in a clockwise or S-twisted yarn.

Underhill also describes two methods of spinning cotton: The Hopi method, which results in a right-handed or S-twisted yarn, consists of rolling the spindle down the right thigh toward the knee; the eastern Pueblo method, which results in a left-handed or Z-twisted yarn, consists of rolling the spindle upward from the knee on the right leg (Underhill, 1944, pp. 36-37).

About 70 per cent of the hard fiber yarn from the two test squares in Tularosa Cave is S-twisted, and in the San Francisco-through-Tularosa mixed levels that is the only type of hard fiber yarn. Z-twisted hard fiber yarn decreases accordingly (Fig. 74).

The spinning of bast fiber is somewhat different. In the Pre-Pottery levels most of the bast fiber yarn is Z-twisted. This type decreases in popularity slowly to 70 per cent in the Georgetown Phase. However, a rapid shift takes place at that time and only

		HARD & BAST FIBER CORD							COTTON CORD				HAIR CORD			TOTAL	FUR CORD							FEATHER CORD				TOTAL
		1 YARN	2 YARN	3 YARN	OTHER	2 STRAND	3 STRAND	OTHER	1 YARN	2 YARN	3 YARN	OTHER	1 YARN	2 YARN	OTHER		A	B	C	D	E	F	TOTAL	A-Q	A-S	B	TOTAL	
TULAROSA CAVE	RESERVE-TULAROSA	2 14.30	8 5714	1 714						2 1428		1 714				14 100		3 2142	1 7.14	1 714		4 28.57	9 6428	5 3572			5 35.72	14 100
	SAN FRANCISCO-TULAROSA	3 166	152 8399	4 220		7 3.87			1 .55	7 387		3 166	1 .55	2 110	1 .55	181 100	11 1000	8 727	16 1454			4 3.63	39 3544	69 6275		2 181	71 64.56	110 100
	SAN FRANCISCO	6 199	241 80.10	8 266	3 .99	9 299	2 66	3 .99	10 3.32	8 2.66	2 .66	6 1.99		2 .66	1 .33	301 100	36 30.76	9 7.70	17 1452	10 854		4 341	76 64.93	34 2910	6 512	1 85	41 35.07	117 100
	GEORGETOWN	8 386	173 83.60	7 338		13 6.28	1 48		1 48					3 144	1 .48	207 100	61 4659	1 76	20 15.26	21 16.03		11 8.39	114 87.03	14 10.68	3 2.29		17 12.97	131
	PINE LAWN—GEORGETOWN		23 9583											1 417		24 100	4 6667						4 6667	2 3333			2 3333	6 100
	PINE LAWN	1 75	124 9253	2 149		5 3.73				1 .75				1 75		134 100	27 3802		15 2112	3 422		15 2112	60 84.48	9 1270	2 2.82		11 15.52	71 100
	PRE-POTTERY	1 .66	132 8742			16 10.60	1 .66		1 .66							151 100	43 3910		22 20.00	21 19.10		23 2090	109 9910	1 .90			1 .90	110 100
	TOTALS	21	853	22	3	50	4	3	13	18	2	10	1	9	3	1012	182	21	91	56		61	411	134	11	3	148	559
CORDOVA CAVE	LATE	1 263	30 78.94	1 263		3 7.90				3 7.90						38 100	3 3333				1 11.11		4 4444	5 55.56			5 55.56	9 100
	PLAIN WARE	11 2340	32 6810			4 8.50										47 100	5 3333	1 6.66		6 40.03			12 8002	1 6.66	1 666	1 666	3 19.98	15 100
	PRE-POTTERY	2 6.06	24 73.03	1 3.03		5 15.15								1 3.03		33 100	8 53.35		1 6 66	5 3333			14 9334		1 666		1 6.66	15 100
	TOTALS	14	86	2		12				3				1		118	16	1	1	11	1		30	6	2	1	9	39
TOTAL BOTH CAVES		35	939	24	3	62	4	3	13	21	2	10	1	10	3	1130	198	22	92	67	1	61	441	140	13	4	157	598

FIG. 74. Occurrence of cordage types by phases, Tularosa and Cordova caves.

30 per cent of the bast fiber yarn in the San Francisco Phase is S-twisted.

About 67 per cent of the cotton yarn from Tularosa Cave is Z-twisted. The yarn used in cotton textiles is also Z-twisted, which suggests that the apparent predominance of S-twisted cotton yarn in the Reserve-Tularosa levels (Fig. 75) is probably due to the small sample.

From these data it is possible to make some inferences concerning spinning techniques in the Mogollon area. If we assume that the pattern of motor habits involved in spinning persists through time and that the majority of the Mogollon population was right-handed, it can be suggested that hard fiber yarn was usually spun without a spindle by rolling the fibers downward on the right thigh with the right hand as the Indians do today, since it is predominantly S-twisted. Most cotton yarn probably was spun by the eastern Pueblo method rather than the Hopi, as most of it is Z-twisted.

Nearly all bast fiber from the Pre-Pottery levels is Z-twisted, but this type decreases from the Pine Lawn Phase on, while S-twisted bast fiber increases. In the light of these suggestions, perhaps we may assume that some other method of hand-spinning bast fiber, resulting in Z-twisted yarn, was more important during the Pre-Pottery times and through the Georgetown period; then it was replaced by the method of rolling the yarn downward with the right hand on the right thigh—a technique which is used throughout when spinning hard fiber and which produces an S-twisted yarn. It is also possible that during Pre-Pottery times and through the Georgetown period, the majority of bast fiber yarn was spun in the eastern Pueblo manner on a spindle while only a little was spun on the thigh, since the yarn is predominantly Z-twisted. With the increased utilization of cotton, a more suitable fiber for textiles and one easier to spin by the spindle method, there was a shift to thigh spinning, without spindle, of bast fiber, and the twist was reversed.

It may seem more reasonable to suggest that the Z-twisted bast fiber yarn results from a Pre-Pottery use of the spindle, but there is a possibility that from prehistoric to historic times there was a complete shift in the pattern of motor habits involved in spinning. Pottery spindle whorls are known from Pine Lawn (open sites) on, and a perforated gourd disk that may have served that purpose comes from a Pre-Pottery level of Cordova Cave.

A study of the texture of bast fiber yarns included in both cords and textiles indicates that the S-twisted yarns tend to be finer

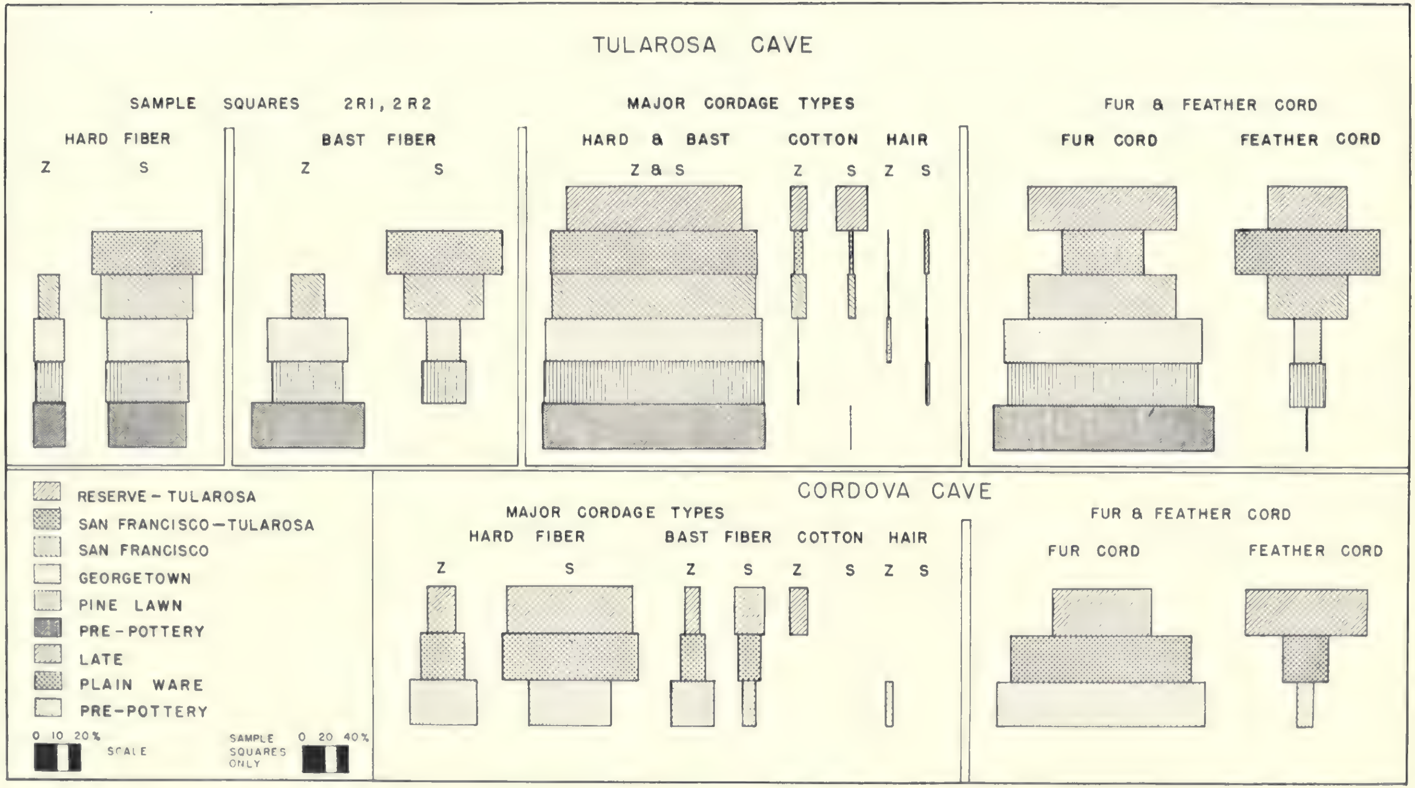


FIG. 75. Chart showing relationships of fur to feather cordage and of twist directions of cordage yarns by phases, Tularosa and Cordova caves.

(smaller in diameter and more evenly twisted) than the Z-twisted yarns. This suggests that, whatever the earlier method, the downward, right-handed thigh method always provided better control for the coarse, uneven bast fibers. The bast fiber yarn woven into cloth is entirely S-twisted. Hair yarn was both S- and Z-twisted in approximately equal quantities.

Two-yarn cord is the predominant type of twisted fiber cord in both Tularosa and Cordova caves, although 1-yarn, 3-yarn, 4-yarn, 5-yarn, 6-yarn, 2-strand, 3-strand, 4-strand, 6-strand, and 12-strand cords were present. A few cords of all types of fiber were dyed red or black, and one piece of cotton was dyed yellow.

In the data on cordage from other parts of the Southwest and adjacent areas, all cordage is usually treated as a unit. For this reason we wish to summarize the Tularosa and Cordova Cave samples as follows: Cordage from the Reserve area consists, for the most part, of 2-yarn strands, regardless of fiber. Most of the hard fiber strands are Z-twisted (S-twisted yarn), irrespective of phase. Bast fiber strands are predominantly S-twisted (Z-twisted yarn) in the Pre-Pottery Phase of Cordova Cave and the Pre-Pottery, Pine Lawn, and Georgetown periods of Tularosa Cave, and are usually Z-twisted (S-twisted yarn) after that. Cotton yarn is predominantly Z-twisted. Hair cord may be twisted either way and is represented by very few strands.

Cosgrove (1947, pp. 67–68) finds that the majority of the cordage from the Upper Gila caves is 2-strand, Z-twisted. Use of red, yellow, and black dyes for coloring cords is reported from that area. In the hair cord that is found, animal hair was spun in an S-twist, and human hair was spun in a Z-twist.

In Ventana Cave 2-yarn cords are the most common. Yucca or hard fiber cords are the predominant type, and the majority of the cordage is Z-twisted. Only the six fragments of human hair cord are predominantly S-twisted (Haury, 1950, pp. 391–394).

The bulk of the cordage from Basketmaker and Pueblo sites in the Anasazi area appears to be 2-yarn, Z-twisted (Kidder and Guernsey, 1919, p. 113; Nusbaum, Kidder and Guernsey, 1922, p. 103; Bartlett, 1934, p. 45; Haury, 1934, pp. 84–85; Haury, 1945b, p. 48). From the illustration of a spindle with cotton yarn attached, from Canyon Creek Ruin (Haury, 1934, pl. 58), it seems likely that the spinning method used was the same as that of the eastern Pueblo Indians rather than that of the Hopi. The yarn is wound counterclockwise on the spindle and should, therefore, be Z-twisted.

In the Great Basin, Cressman (1942, pp. 77, 150, 151) reports S-twisted bast fiber cord. A predominance of S-twisted hard and some bast fiber cord was found at Gypsum Cave, although apocynum cords were Z-twisted (Harrington, 1933, pp. 158–161). In Lovelock Cave the majority of the rope was Z-twisted. It is made of various types of rushes. However, bast fiber twine from the same site is usually S-twisted (Loud and Harrington, 1929, p. 79, Pls. 35 and 36). Promontory Cave cordage is equally divided between S- and Z-twist (Steward, 1937, pp. 37–40).

Cordage from several sites in the Big Bend area of Texas is also predominantly 2-strand, Z-twisted (Holden, 1937, p. 61; Quinn and Holden, 1949, p. 118).

In summary, the most common type of cord reported from the entire Southwest and adjacent areas seems to be 2-yarn Z-twisted. In those sites where a distinction has been made in the material, there is a tendency for the bast fiber cord to be S-twisted while the hard fiber cord is Z-twisted. This situation is true of the early levels of Tularosa and Cordova caves, the Oregon caves, and Lovelock Cave. In Gypsum Cave, however, both hard and bast fibers are S-twisted and only a little bast fiber is Z-twisted. Ventana Cave, where bast fiber cord is predominantly Z-twisted, is similar to the later levels of the caves of the Reserve area.

Cotton yarn, which may be as old as the Pre-Pottery Phase in Tularosa Cave, is earlier than cotton reported from Anasazi (Baldwin, 1939b, p. 17) and Hohokam (Haury, 1950, pp. 319–394) sites. Cotton cord is also reported from the Pueblo levels of Gypsum Cave (Harrington, 1933, pp. 158–161).

Hair cord is found throughout the caves but is never more than 2 per cent of the sample in a given level. It seems to be a more important type in the Anasazi area (Kidder and Guernsey, 1919, p. 113; Haury, 1945b, p. 48). Hair cord is also reported from Gypsum Cave (Harrington, 1933, pp. 158–161), Lovelock Cave (Loud and Harrington, 1929, pp. 72–83), and Oregon (Cressman, 1942, p. 77). Evidently it was a widely known type.

Fur and Feather Cordage

In Tularosa and Cordova caves 598 pieces of fur and feather cord were found. Six types of fur cord were identified. Type A (strips of fur wrapped around a cord in an S-twist) is the most common. Types C and D (one twisted strip of fur and two twisted strips of fur, without cord), when combined, form the second most important group.

Type A-Q feather cord (quills wrapped around string in an S-twist) is the most common type, although there was some Type A-S (strips of bird skin with feathers attached, wrapped around a cord).

Fur cord tends to be more important in the early levels of Tularosa Cave. While feather cord is important in the later levels, it is predominant only in the San Francisco-through-Tularosa mixed levels. It also is the more important type in the Late levels of Cordova Cave (Fig. 75).

Fur cord and feather cord are known throughout the Southwest. Cosgrove reports fur cord identified as S-twist types A and D. The most common feather cord type in the Upper Gila area was the equivalent of Type A-Q (Cosgrove, 1947, pp. 66–67).

In the Anasazi area fur cord seems to be more important in the Basketmaker II and III phases. Feather cord similar to Type A-S is found in Basketmaker sites (Nusbaum, Kidder and Guernsey, 1922, p. 104). In Pueblo II and III times, when feather cord is the more predominant type, the cordage is the A-Q type (Kidder and Guernsey, 1919, p. 174; Morris, 1919, p. 48; Bartlett, 1934, p. 46).

Types A, B, C, D, and E fur cord are found in Ventana Cave, but feather cord is rare (Haury, 1950, pp. 394–396).

Types A and D fur cord and A-S feather cord are found in Lovelock Cave (Loud and Harrington, 1929, pp. 50–53). Both fur and feather cord from the Promontory caves consist of strips of skin twisted without cord foundation (Steward, 1937, p. 40). This type (D) seems to be the Basin type, while Type A is the important type in the Southwest.

Knots

Square knots are predominant in both Tularosa and Cordova caves, and overhand knots were second in popularity. The granny knot is rare. Lark's heads, sheetbends, clove hitches, and others appear occasionally (Fig. 76). As most of these knots were tied in strips of yucca leaves, rather than in cords, it is possible that they represent portions of yucca carrying nets.

Square knots are reported from Canyon Creek Ruin (Haury, 1934, p. 87) and Medicine Cave (Bartlett, 1934, p. 45).

At the Fate Bell Shelter, a Texas site, square knots constituted about 60 per cent of the collection, overhands were about 23 per cent, and there were a few lark's heads, grannies, sheetbends, and others (Pearce and Jackson, 1933, p. 92).

At Ventana Cave, overhand and square knots predominate, while granny knots are rare. Sheetbends were used in netting; draw knots, carrick bends, and lark's heads are also present (Haury, 1950, pp. 397–398).

Steward reports overhand knots as the most common type in the Promontory caves (Steward, 1937, pp. 36–37). The Lovelock Cave knot collection contrasts markedly. At that site, 185 (about 46 per cent) of the knots were mesh knots (sheetbends), 83 (20 per cent) were overhand knots, and there were four times as many granny knots as square knots. Slip knots and clove hitches were also found (Loud and Harrington, 1929, pp. 84–87).

It would seem, therefore, on the basis of this evidence, that the square knot was the important type in the Southwest and Texas, while the overhand and sheetbend were more important in the Basin.

Cordage Artifacts

Two bundles of large rope-snares were recovered from the Pre-Pottery levels of Tularosa Cave. These snares are similar in size to those reported from Chavez Cave by Cosgrove (1947, p. 137), but they were made with a different knot or splice construction of the noose. Cosgrove also describes a collection of Pueblo III snares that are twisted to the right (S-twisted) or the opposite direction and are of greater length than the Tularosa Cave specimens (Cosgrove, 1947, p. 138). Similar long rope-snares are reported from Pueblo II sites in the Fremont drainage (Morss, 1931, p. 70, Pl. 34). Some of these snares have loops at each end.

Basketmaker II snares 49 inches long with 8-inch strings and wooden toggles are reported from the Kayenta area (Guernsey, 1931, p. 71). Other Basketmaker snares 8 feet 6 inches and 7 feet 4 inches long are reported from northeastern Arizona (Guernsey and Kidder, 1921, p. 79, Pl. 32). These are described as braided snares with 6-strand loops and 12-strand ropes.

A snare with a 50 cm. diameter loop made of 2-strand sagebrush bark rope 2 cm. in diameter is reported from an Oregon cave (Cressman, 1942, pp. 77–78).

It is apparent that large rope-snares were widely used during all time periods by the people of the Southwest and adjacent areas.

The general size of these artifacts is roughly the same, but the details of both rope and noose construction differ.

Several small snares were also found in Tularosa Cave. They were usually made by tying slippery hitches in small 2-yarn cords and were probably used for snaring birds or small animals. One such snare was attached to a stick (Fig. 148, *b*).

Various types of "carrying devices" were found in both Tularosa and Cordova caves. These include "handcuff" carrying loops, carrying loop chains, carrying nets, and burden straps of yucca and cord.

The function of these specimens is problematical. The "handcuff" carrying loops are believed to be carrying devices because of their similarity to modern package handles and because one specimen was found with a piece of yucca stalk thrust through one of the loops.

The carrying loop chains resemble specimens found in Pueblo III sites in the Anasazi area (Fewkes, 1909, p. 47, Fig. 27, and 1911, p. 77; Morris, 1911, p. 180, Pls. 52, 54, 55; Haury, 1945b, p. 50, Pl. 21). In that area, the loops have been found with herbs and corn cobs caught in them. Fewkes suggested that they might have been part of the ceremonial paraphernalia, as the Hopi use a similar device with six loops to hold corn cobs in their ceremonies. However, the number of loops per chain varies, and most of the reported specimens have more than six. It is possible that they are part of tied-twined corn-husk cist linings as reported from Dupont Cave (Nusbaum, Kidder and Guernsey, 1922, Pl. 54).

The burden straps of yucca and cord, while not found directly attached to loads or packs, are so called because of their resemblance to the head bands of modern tump lines.

In the collection of knots tied in strips of yucca leaves, there were several fragments of what appeared to be coarse, irregular mesh nets, tied with overhand and square knots. A fragmentary net of shredded bark was found around a Three Circle Neck Corrugated pot in Cordova Cave. Coarse nets resembling these fragments have been found elsewhere. Pearce and Jackson (1933, p. 93, Fig. 21) report three grass nets from the Fate Bell shelter in Texas. Morris (1911, p. 180, Pl. 55) found a similar specimen with a netted hoop base in an Anasazi site.

When considered as a unit, the majority of these carrying devices are found in the Georgetown Phase levels, where there is also a marked increase in the quantity of gathered food material (Fig. 76).

Description

Twisted Fiber Cordage

Material.—The following types of fibers are used in the construction of cordage from Tularosa and Cordova caves:

Hard fibers: Greatly thickened, elongated cells found in the leaves and stems of many monocotyledonous plants; commercial examples of such fibers are sisal, manila hemp, and yucca.

Bast fibers: Elongated strengthening cells found in the phloem of plants. Flax, hemp, jute, ramie, and Indian hemp or apocynum are bast fibers.

Surface fibers: Single-celled fibers borne on the surface of plant parts. Surface fibers of cotton plants are attached to the seeds.

Hair: Usually animal, although some of it is human.

Cordage from two squares (2R1 and 2R2) of Tularosa Cave was selected for intensive analysis as to material and twist. About 61 per cent of this sample was made of hard fiber, 34 per cent of bast, 4 per cent of cotton and 1 per cent of hair. Bast fiber increases in popularity through time from about 25 per cent in the Pre-Pottery levels to 66 per cent in the San Francisco-through-Tularosa mixed levels, and hard fiber decreases correspondingly.

The sample of cotton and hair cord from the two squares is too small to indicate the distribution of those fibers through time in the cave. The total collection, however, shows that cotton was present in small quantities in all phases, increasing during the San Francisco Phase; and hair cordage was present in small quantities from the Pine Lawn Phase through the San Francisco-through-Tularosa mixed levels.

In Cordova Cave, hard fiber is the predominant material in all levels, representing about 75 per cent of the total cordage. Cotton appears only in the Late levels and hair cord only in the Pre-Pottery levels.

Manufacture.—The cordage sample from Tularosa and Cordova caves includes the following types:

Yarns: Single elements produced by twisting two or more fibers.

Strands: Two or more yarns twisted together. Specimens from the Reserve area include 2-, 3-, 4-, 5-, 6-, and 8-yarn strands.

Multiple-strand cordage: Produced by twisting two or more strands together. Specimens from Tularosa and Cordova caves include 2-, 3-, 4-, 6-, and 12-strand cords.

During construction, all types of cordage are twisted either in a Z-twist (laid or twisted to the left; counter clockwise) or an S-twist (laid or twisted to the right; clockwise). As a rule, when twisting a single strand from two or more yarns, the strand twist is the reverse of the yarn twist. When strands are then twisted into multiple-strand cord, the twist of the final cord is the reverse of that of the strands. Only rarely do the strands and yarns or multiple-strand cords and strands twist in the same direction.

About 70 per cent of all hard fiber yarn from the Pre-Pottery levels of squares 2R1 and 2R2 is S-twisted; this type increases in popularity through time until it is the only type of hard fiber yarn found in the San Francisco-through-Tularosa mixed levels. There is a decrease in the amount of Z-twisted hard fiber yarn from 30 per cent in the Pre-Pottery level to 18 per cent in the San Francisco level.

The only type of bast fiber yarn in the Pre-Pottery levels of the test squares is Z-twisted. This type decreases in popularity while the S-twisted yarn increases and becomes the only type present in the San Francisco-through-Tularosa mixed levels. The major shift from Z-twist to S-twist occurs between the Georgetown and San Francisco phases. In the Georgetown Phase 70 per cent of the yarn is Z-twisted and in the San Francisco Phase 70 per cent is S-twisted.

Of the cotton yarn from the entire Tularosa Cave collection 68 per cent is Z-twisted, and 32 per cent is S-twisted. The hair yarn is 54 per cent Z-twisted and 46 per cent S-twisted. These samples are too small to be significant when considered by levels.

The Cordova Cave cordage collection exhibits the same general trends as the Tularosa material, but the percentages frequently differ.

The most common type of cordage in the caves was 2-yarn, made of either hard or bast fiber. The twist of the strand was either S or Z, depending on the twist of the yarn. The strands varied from 0.5 to 9 mm. in diameter; however, most of them were between 1 and 3 mm. Some fragments were tightly twisted, others loosely constructed (Fig. 77). One fine strand, 0.5 mm. in diameter, had 71 twists per 10 cm., and a heavy cord, 9 mm. in diameter, had 8 twists per 10 cm. Cords from 2 to 3 mm. in diameter had from 14 to 30 twists per 10 cm. length, with a median of 18.

Two-strand hard or bast fiber cord was the second most common type. This cord tends to be slightly larger in diameter than 2-yarn cord. It varies from 1.5 to 6.5 mm., averaging between 3 and 4 mm. It is usually more tightly twisted than the 2-yarn cord, the number of twists varying from 12 per 10 cm. for a 6.5 mm. cord to 36 per 10 cm. for a 1.5 mm. cord.

Other types of hard and bast fiber cordage included single yarns, 3- and 4-yarn strands, and 3- and 4-strand cordage.

The most common types of cotton cordage from the caves are single yarns and 2-yarn strands. The yarn varied from about 0.3 mm. to 1 mm. in diameter. The 2-strand cords vary from 0.5 to 3 mm. in diameter, and twists vary from 10 to 30 per 10 cm. length. Multiple-yarn cotton cordage includes a few 4-, 5-, 6-, and 8-yarn pieces. The heaviest cordage is 4 mm. in diameter. In general, cotton cordage is softer than that of hard and bast fiber.

The predominant type of hair cordage is 2-yarn. Cords vary in diameter from 0.5 to 4 mm. and have from 16 to 34 twists per 10 cm. length. The 4 mm. specimen has 24 twists per 10 cm. and the 0.5 mm. fragment has 30. The most tightly twisted fragment, 1.5 mm. in diameter, has 34 twists per 10 cm. There are also 4-yarn, 6- and 12-strand fragments. The 12-strand fragment, the heaviest hair cord in the collection, 5 mm. in diameter, has 10 twists per 10 cm.

The snares, described on page 221, are made of rope, not included in the cordage tabulation. This rope deserves special mention. The Z-twist rope is made of three 2-strand S-twisted cords, which are, in turn, made of two 2-yarn Z-twisted strands, composed of S-twisted hard fiber yarn. The rope, therefore, was built up in the usual way, alternating the direction of twist with each successive step. The final step in the construction was the twisting to the left (Z-twist) of the 2-strand S-twisted cords. Two cords were of one continuous piece folded in the middle. The end of the third cord was inserted through the two elements of the other at the fold and an overhand knot was tied in it to prevent its slipping out or unraveling. All three elements were then twisted together. Another variation of this construction resulted when the third cord was folded over the fold in the other, and the end made fast by working it back into itself before all three cords were twisted. This latter method resulted in a rope with a smooth end.

Occasionally pieces of bast, hard, and cotton cordage have been colored. Both red and black dyes were used, although the red is more common. One piece of cotton cord is dyed yellow. Hair cord is undecorated, but one unusual 2-yarn piece was made by combining a black and a brown yarn, so that the resulting strand is of two colors.

Occurrence by Phases, Tularosa and Cordova Caves.—See Figure 74.

Fur and Feather Cord

Material.—Strips of fur, bird skin with feathers attached, feather quills, or bunches of hair, and hard or bast fiber cord.

Manufacture.—Six types of fur cord were found in Tularosa and Cordova caves. Five of the types are the same as those reported by Haury (1950, p. 396) and therefore his typology was used:

Type A: Cords, or occasionally yarns, wrapped with strips of fur. Usually the fur is wrapped around to the right, producing an S-twisted fur cord.

Type B: Two yarns, or less frequently cords, each wrapped with skin and then twisted together to the right, S-twisted.

Type C: A single strip of fur twisted to the right, or S-twisted.

Type D: Two strips of fur twisted together to the right, S-twisted.

Type E: A 2-yarn cord with tufts of hair caught between the twisted yarns.

Type F: A cord wrapped with two strips of fur. Usually the fur is twisted to the right, an S-twist.

Three types of feather cord were found:

Type A-S: A strip of bird skin, with feathers attached, wrapped around a piece of cord. Examples of this type are either S- or Z-twisted.

Type A-Q: Contour feather quills wrapped around a piece of cord. Quills are usually wrapped to the right or S-twisted. The feather quills were not split, but the veins were broken down after the feathers had been wrapped around the cord. Burred pieces may have been used for this purpose (Fig. 149, *g*, *h*).

Type B: A strip of bird skin with feathers attached, wrapped around a cord, and another cord wrapped around this to hold the skin in place.

Fur cord constituted about 75 per cent of the total fur and feather cord collection from the caves, and was the predominant type in all levels except the Late level of Cordova Cave and the San Francisco-through-Tularosa mixed levels of Tularosa Cave. Types A, C, D, and F are the most important fur cord types in Tularosa Cave, A and D are the most important types in Cordova Cave. Type A-Q is the most important feather cord type in both sites.

Occurrence by Phases, Tularosa and Cordova Caves.—See Figure 74.

Knots

The following knots are present in Tularosa and Cordova caves:

Square or reef knot (Graumont, 1945, p. 28, Fig. 88).
Granny knot (Graumont, 1945, p. 28, Fig. 87).
Overhand or thumb knot (Graumont, 1945, p. 27, Fig. 84).
Single half hitch (Graumont, 1945, p. 3, Fig. 1).
Running overhand knot (Graumont, 1945, p. 27, Fig. 85).
Running noose or slippery hitch (Graumont, 1945, p. 29, Fig. 90).
Clove hitch or ratline hitch (Graumont, 1945, p. 9, Fig. 30).
Single bow (Haury, 1950, p. 397, Fig. 94, *e*).
Running figure-of-eight knot (Graumont, 1945, p. 27, Fig. 82).
Lark's head (Graumont, 1945, p. 3, Fig. 6).
Double bow knot.

Square or reef knots are the predominant form of tie in both caves, representing 90 per cent of the knots in Tularosa Cave and about 83 per cent of those in Cordova Cave. These proportions remain constant throughout the occupation period in each site. Overhand or thumb knots comprise 4 per cent and 11 per cent of the total knots in Tularosa and Cordova caves, respectively, and, like the square knot, remain fairly constant through time. Granny knots are infrequent, but a larger percentage (4 per cent as opposed to 2 per cent) appear in Cordova Cave.

Some of the knots are tied in cords, but the majority were tied in narrow strips of yucca leaves.

Occurrence by Phases, Tularosa and Cordova Caves.—See Figure 76.

Braid

Material.—S- and Z-twisted hard fiber yarn, S-twisted bast fiber yarn, 2-yarn S-twisted hair strands, 2-yarn Z-twisted cotton strands, and rushes (*Scirpus validus*).

Manufacture.—Three types of flat braid were found in Tularosa and Cordova caves:

Three-element braid, from 2 to 34 mm. in width. Twelve of the pieces of braid of this type were of rushes (*Scirpus validus*) and probably represent fragments of the edges of twined and sewed mats (Chaper VI).

Four-element braid, from 5 to 11 mm. in width.

Six-element braid, 15 mm. wide.

Occurrence by Phases, Tularosa and Cordova Caves.—See Figure 76.

		KNOTS									BRAID				CORDAGE ARTIFACTS							
		SQUARE	GRANNY	OVERHAND	SINGLE HALF HITCH	CLOVE HITCH	LARK'S HEAD	SINGLE BOW	DOUBLE BOW	TOTAL	3 ELEMENT	4 ELEMENT	6 ELEMENT	TOTAL	BURDEN STRAPS	CARRYING NETS	CARRYING LOOP CHAINS	"HANDCUFF" CARRYING LOOPS	TOGGLES	COILS	LARGE SNARE	SMALL SNARE
TULAROSA CAVE	RESERVE-TULAROSA	24								24	1	1		2					1			
	SAN FRANCISCO-TULAROSA	679	15	32	2			5		733	4	1	1	6		1			3	5		2
	SAN FRANCISCO	325	6	29		1		3		364	4	2		6		1		3		1		1
	GEORGETOWN-SAN FRANCISCO	29	1	2						32												
	GEORGETOWN	388	4	26	2	1		3		424	5			5	4	2	1	6		1		3
	PINE LAWN-GEORGETOWN	16	4	2						22	1			1				1				
	PINE LAWN	190	5	13			1			209	2			2		1	1	1		1		
	PRE-POTTERY	211	7	9				2	1	230	5			5		1	4	1	1	1	13	2
	TOTAL	1862	42	113	4	2	1	13	1	2038	22	4	1	27	4	6	6	12	5	9	13	8
CORDOVA CAVE	LATE	207	9	23	2					241						1				1		
	PLAIN WARE	107	9	19	2					137		1		1						1		1
	PRE-POTTERY	68	2	8						78		1		1						2		
	TOTAL	382	20	50	4					456		2		2						4		1
TOTAL BOTH CAVES		2244	62	163	8	2	1	13	1	2494	22	6	1	29	4	7	6	12	5	13	13	9

FIG. 76. Occurrence of cordage artifacts by phases, Tularosa and Cordova caves.

Snares

(Figures 76, 78, 79)

Material.—Hard fiber cordage.

Manufacture.—Snares found in Tularosa and Cordova caves can be divided on the basis of size into two categories: small and large.

Small snares are made by tying slippery hitch knots (Graumont, 1945, p. 29, Fig. 90) or occasionally running overhands (Graumont, 1945, p. 27, Fig. 85), in 2-yarn or 3-strand cords, varying in diameter from 2 to 5 mm. One specimen was made of 3-element braid 3 mm. wide.

The large snares are made of 3-strand Z-twisted rope, 13 mm. in diameter and about 2.5 meters long (p. 217). At one end of each rope a noose is made by tying either a figure-of-eight knot (Graumont, 1945, p. 27, Fig. 81) or a slippery hitch through which the running end of the rope is drawn. The running end is tied in an overhand knot to prevent unraveling, and below this one or more of the three component strands hang free for a distance varying from 39 to 90 cm. Overhand knots are tied in the end of the component strands to prevent their unraveling.

The thirteen large snares were coiled in two bundles, six in one and seven in the other. Each bundle was tied together with the free ends of two snares, one on either side, and a thin piece of yucca fiber.

Occurrence by Phase, Tularosa Cave.—Pre-Pottery, 14 (1 small, 13 large); Pine Lawn, 1 small; Georgetown, 3 small; San Francisco, 1 small; San Francisco-through-Tularosa, 2 small.

Occurrence by Phase, Cordova Cave.—Plain Ware, 2 small.

Coils

(Figures 76, 80)

Material.—Hard fiber, 2-yarn, Z- or S-twisted cord, woody sewing splints, or strips of yucca.

Manufacture.—Pieces of string or narrow strips of yucca leaves are wound into small coils, from 1 to 3 cm. in diameter. The ends are usually tied together or wrapped around the coil to keep it from unwinding (Fig. 80, *a–e*, *g*, *i*).

Coils of woody sewing splints are similar to watch springs in appearance. Splints 1 or 2 mm. wide spiral out from the center in

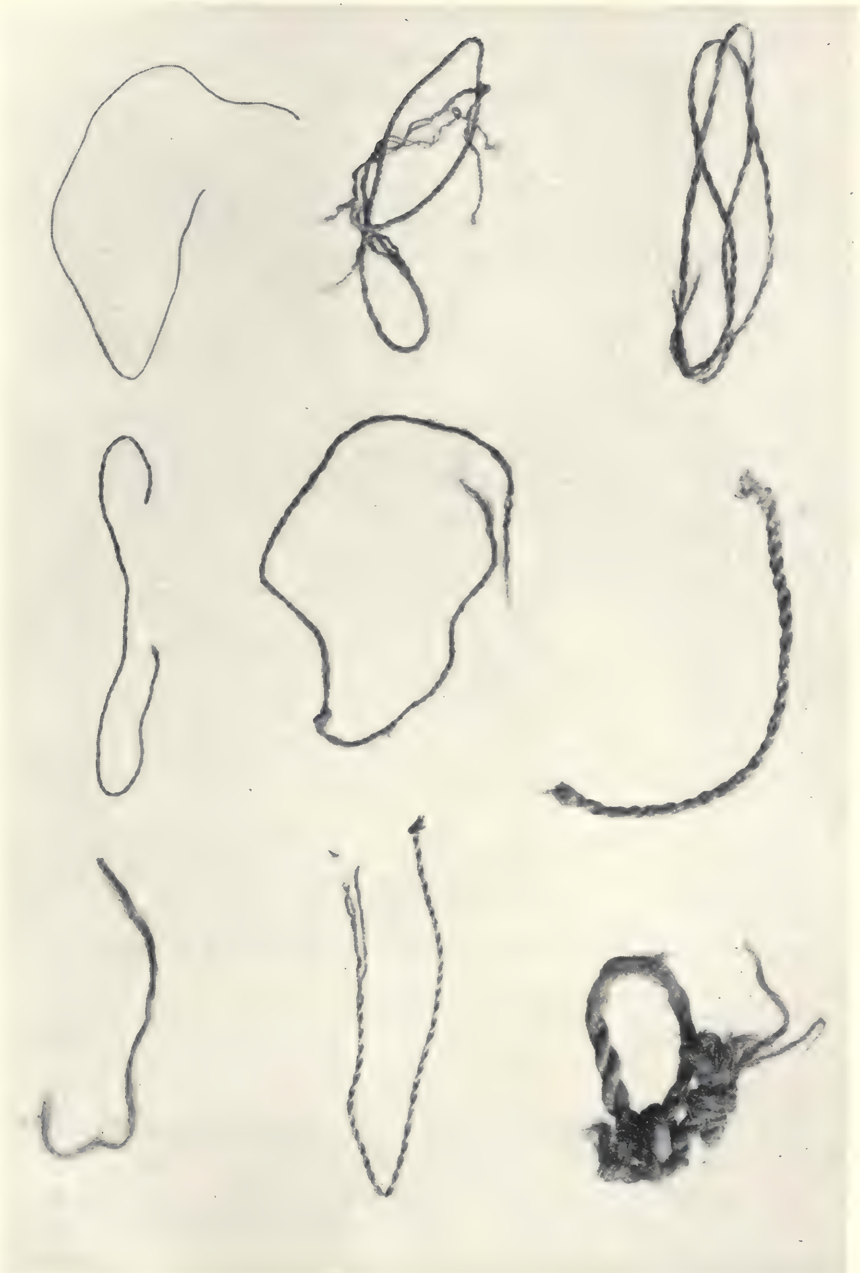


FIG. 77. Hard and bast fiber cordage, showing range of diameters. Largest diameter, lower right, 9 mm.

a flat, tight, oval coil from 2 to 3 cm. in diameter. In one coil, a 2-yarn, Z-twisted hard fiber cord passes under the last complete turn, binding the free end of the splint to it, thereby preventing its unwinding (Fig. 80, *f*, *h*, *j*).

Occurrence by Phases, Tularosa Cave.—Pre-Pottery, 1 string; Pine Lawn, 1 yucca strip; Georgetown, 1 yucca strip; San Francisco, 1 woody splint; San Francisco-through-Tularosa, 5 (2 string, 3 yucca).

Occurrences by Phases, Cordova Cave.—Pre-Pottery, 2 (1 woody splint, 1 yucca strip); Plain Ware, 1 string; Late, 1 woody splint.

Toggles

(Figures 76, 81, *b–d*)

Material.—Yucca leaves (*Yucca baccata* Torr.) and small, unpeeled sticks.

Manufacture.—A yucca leaf is folded over a stick, and a second leaf forms a loop around the folded ends of the first. The free ends of the second pass through a split in the folded ends of the first, one above and one below the horizontal loop, and are tied in a square knot.

Occurrence by Phases, Tularosa Cave.—Pre-Pottery, 1; San Francisco-through-Tularosa, 3; Reserve-Tularosa, 1.

"Handcuff" Carrying Loops

(Figures 76, 82, *d–h*)

Material.—Strips of yucca leaves (*Yucca baccata* Torr.), or, in one specimen, an unpeeled twig.

Manufacture.—Two strips of yucca leaves are each tied in a square knot, forming two separate loops. The free ends of the loops are then tied together in a square knot, producing a handcuff-shaped object. Sometimes the single strips of yucca are not long enough, and the initial loops are each made of two strips, tied at the bottom of the loop.

One specimen is made of two twigs. The twigs are tied together in a square knot, and in each end a loop is produced by wrapping the end about the twig.

Loops usually vary in diameter from 4.5 to 13 cm., although the loops in the twig are 2 cm. in diameter. The distance between the loops ranges from 12 to 19 cm.

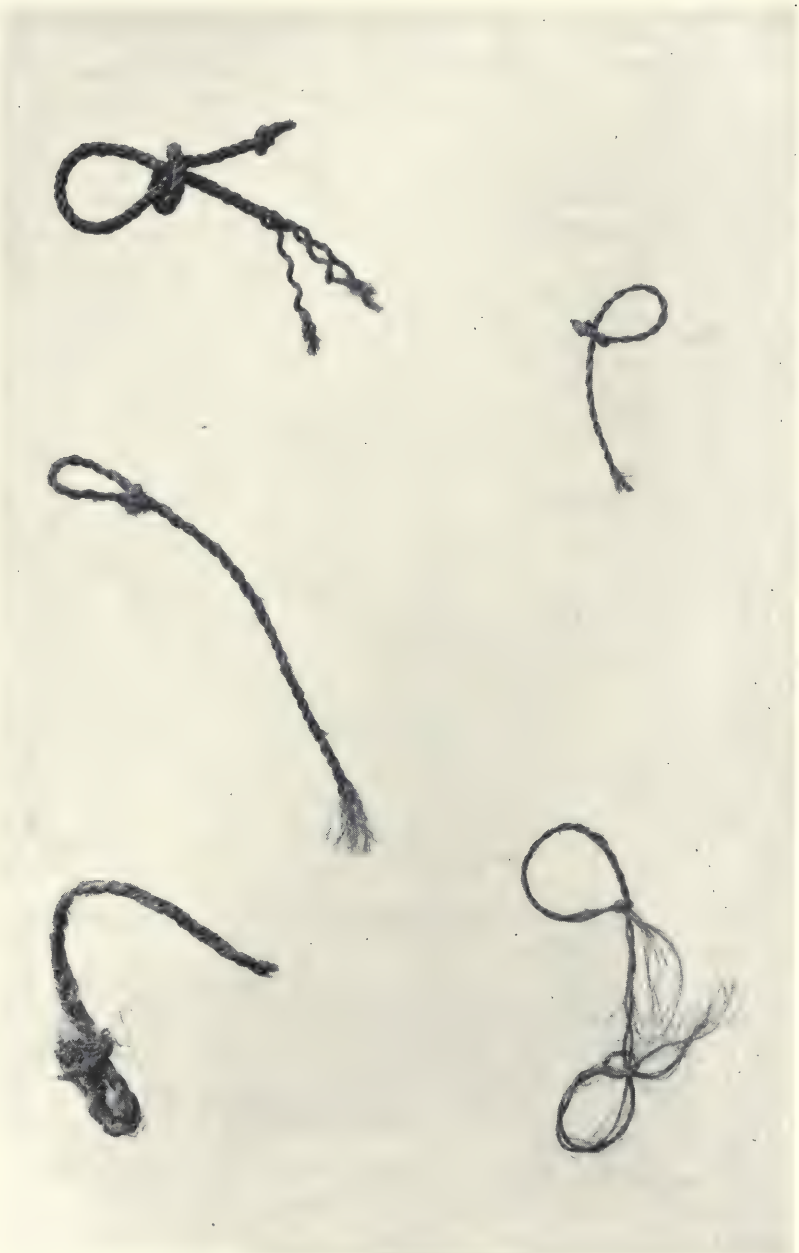


FIG. 78. Small snares. Length, upper right, 8.7 cm.

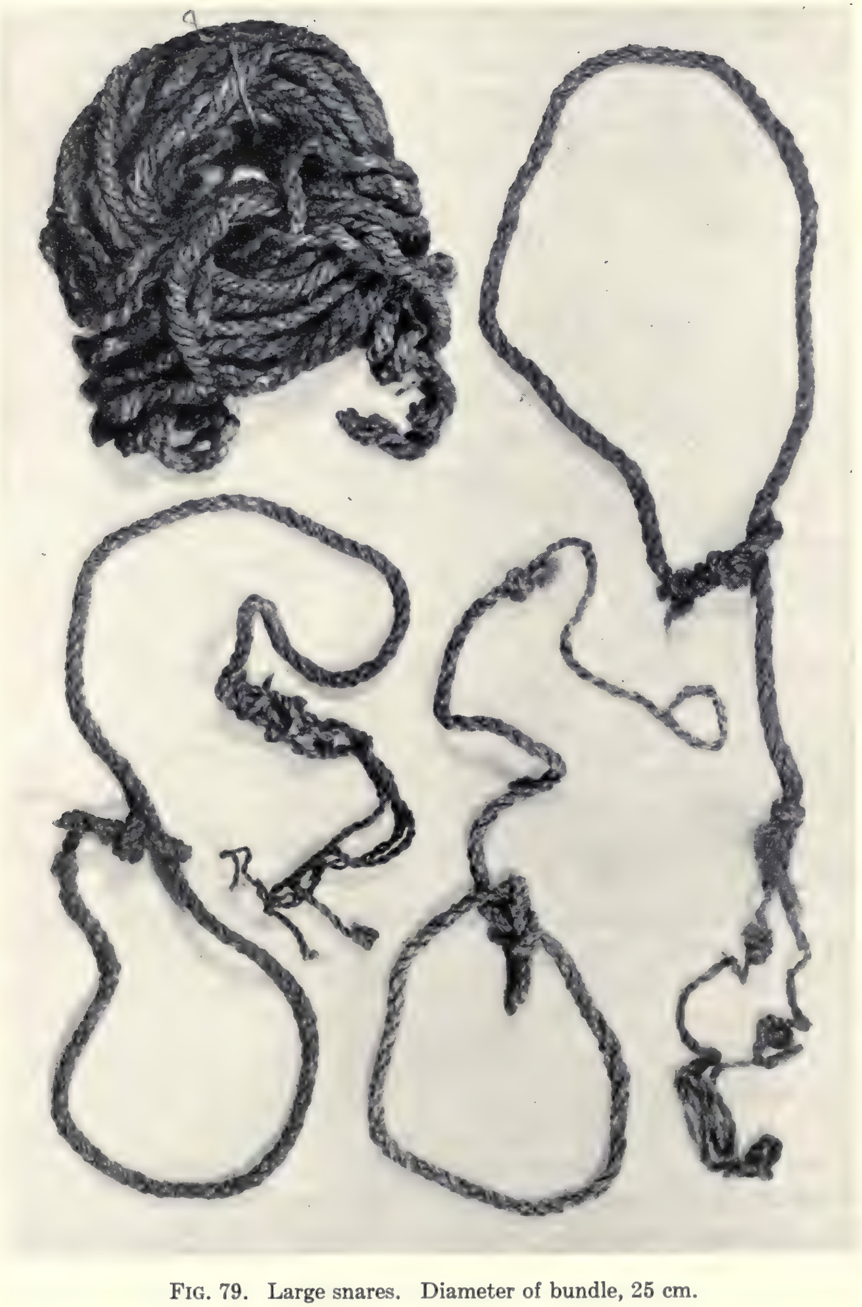


FIG. 79. Large snares. Diameter of bundle, 25 cm.

Possibly these were carrying devices in which the object to be transported was placed in the loops and the fiber connecting them served as a handle. One specimen from the Pre-Pottery Phase in Tularosa Cave had a piece of yucca stem with the edible young flower portion in such a position.

Occurrence by Phases, Tularosa Cave.—Pre-Pottery, 1; Pine Lawn, 1; Pine Lawn-through-Georgetown, 1; Georgetown, 6; San Francisco, 3.

Carrying-Loop Chains

(Figures 76, 82, *a–c*)

Material.—Strips of yucca leaves (*Yucca baccata* Torr.), in two specimens, 2-yarn hard fiber cord.

Manufacture.—A chain of loops is produced by tying two yucca strips or cords together with a series of overhand knots. The loops at either end of the chain are closed by tying the elements together in a square knot. Short strands are lengthened by tying in additional strands with square knots.

In one Pre-Pottery specimen, two small nooses were attached to one end of the chain, in a manner resembling the "handcuff" carrying loops.

The individual loops of the chain vary from 4 to 9 cm. in diameter. The loops on the cord chains are 2 cm. in diameter. One chain of seven loops is 43 cm. long; others are incomplete.

These chains may have been used as carrying devices or for drying corn.

Occurrence by Phases, Tularosa Cave.—Pre-Pottery, 4; Pine Lawn, 1; Georgetown, 1.

Carrying Nets(?)

Material.—Narrow strips of yucca leaves (*Yucca baccata* Torr.). In Cordova Cave one net was made of shredded bark.

Manufacture.—Narrow strips of yucca leaves are tied with square knots and overhand knots to produce large sections of nets(?) with irregular and uneven mesh, varying from 4 to 8 cm.

Specimens are too fragmentary to determine the completed size, shape, or pattern of construction. One shredded bark net in fragmentary condition was found around a large Three Circle Neck Corrugated pot in Cordova Cave.

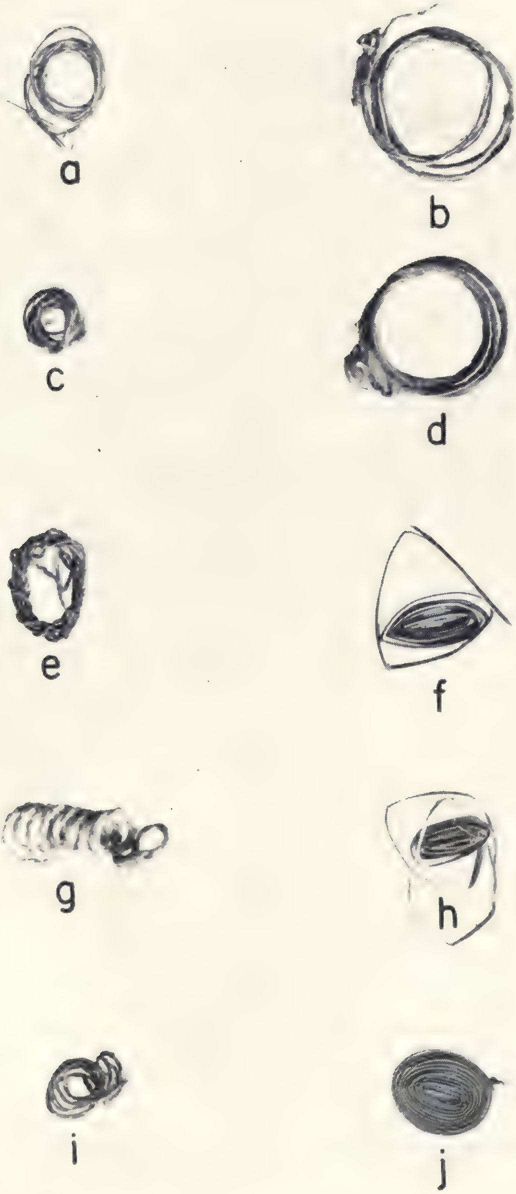

a
b
c
d
e
f
g
h
i
j

FIG. 80. Coils: yucca strip (*a–d*), string (*e*, *g*, *i*), and woody splint (*f*, *h*, *j*). Diameter of *j*, 3.0 cm.

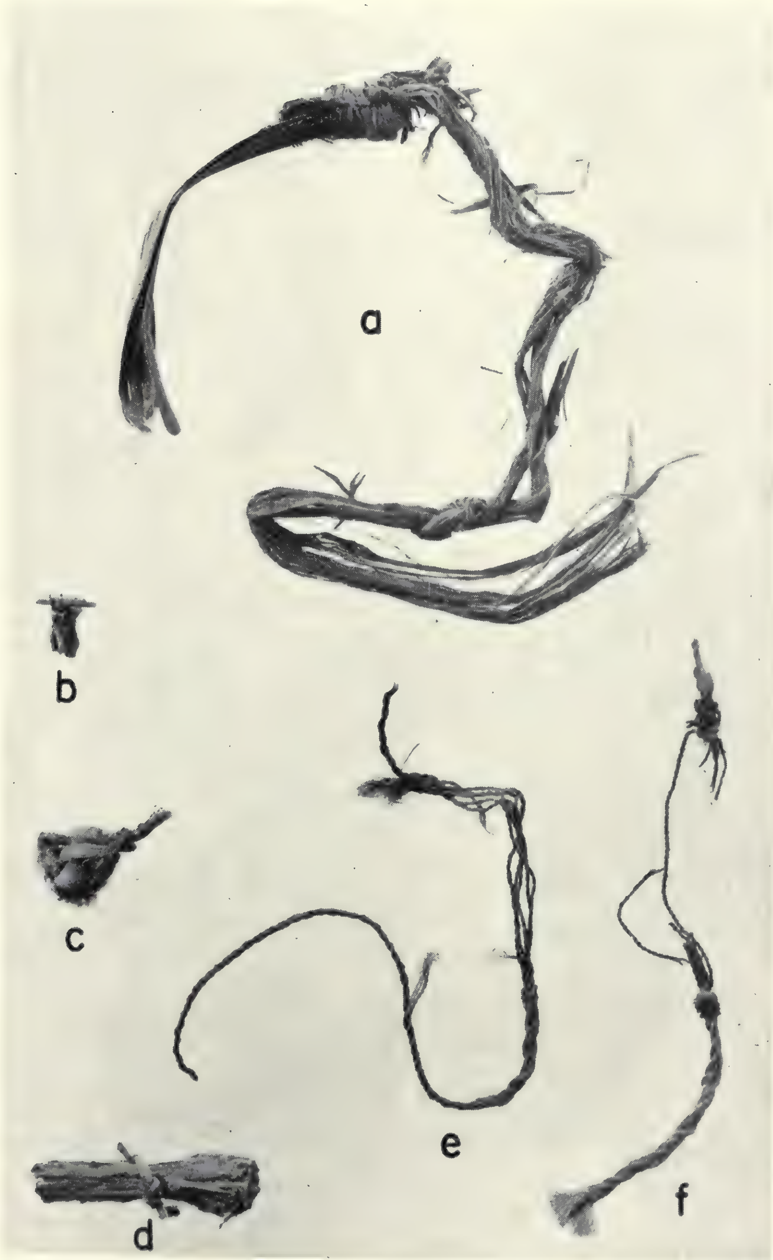


FIG. 81. Burden strap of yucca (*a*), toggles (*b–d*), and burden straps of cord (*e*, *f*). Length of *d*, 12.4 cm.

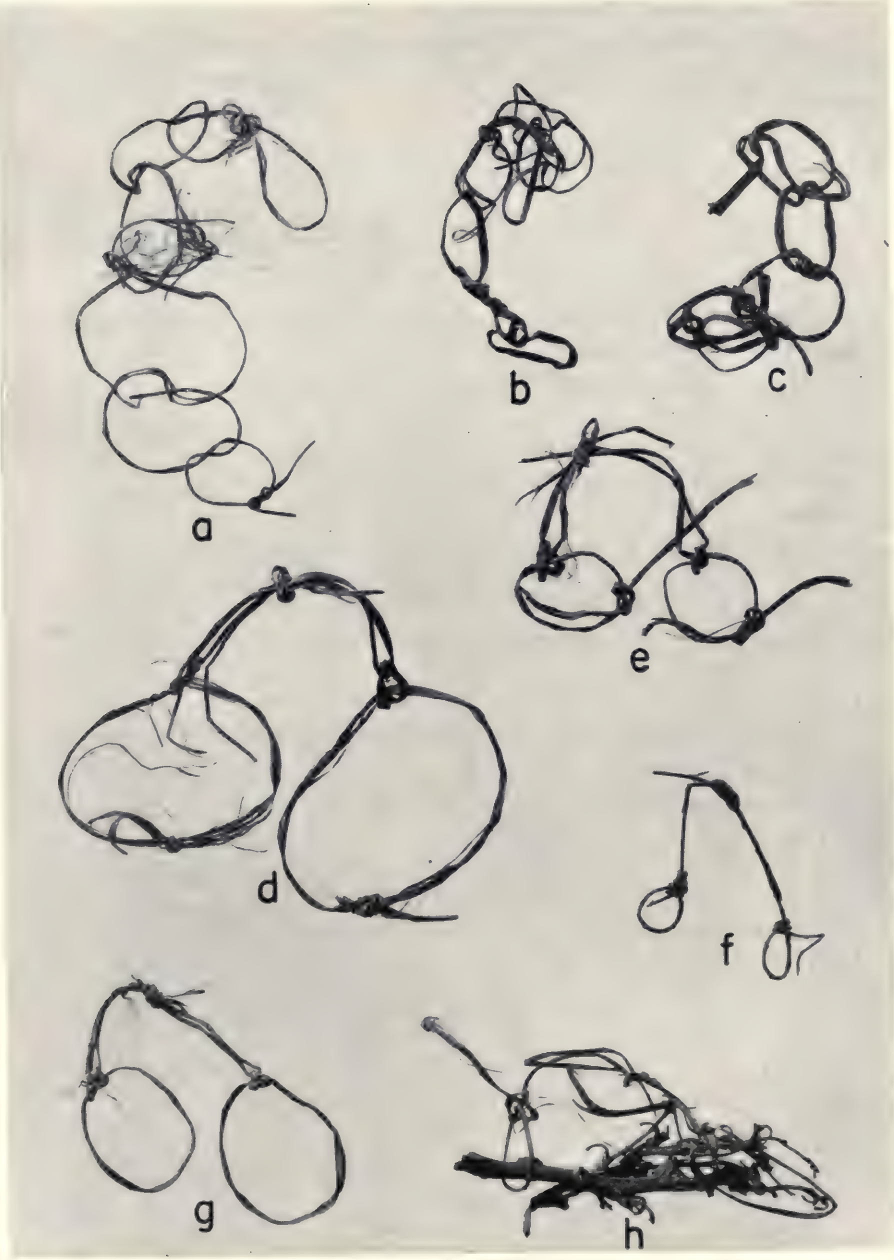


FIG. 82. Carrying-loop chains (*a–c*) and "handcuff" carrying loops (*d–h*). Length of *a*, 43 cm.

Occurrence by Phases, Tularosa Cave.—Pre-Pottery, 1; Pine Lawn, 1; Georgetown, 2; San Francisco, 1; San Francisco-through-Tularosa, 1.

Occurrence by Phase, Cordova Cave.—Late, 1.

Burden Straps of Yucca

(Figures 76, 81, *a*)

Material.—Whole yucca leaves, some of which had been mashed before they were used.

Manufacture.—Whole leaves, mashed or plain, form the strip which is placed across the forehead. At either end, additional mashed leaves are attached with square knots. Presumably this band was attached to a pack or load placed on the back of the carrier.

Occurrence by Phase, Tularosa Cave.—Georgetown, 2.

Burden Straps of Cord

(Figures 76, 81, *e*, *f*)

Material.—Z-twisted hard fiber cord and Z-twisted hair cord.

Manufacture.—The forehead band consists of a bundle of fine (2 mm. diameter) cords (6 hair cords in one band, 4 fiber cords in the other), from 19 to 20 cm. long. At either end the bands are tied to heavier fiber cord (4 to 5 mm. diameter) in a square knot. The free ends of the band are either tied around the knot and cut off or twisted in with both ends of the heavier cords as they extend back toward the pack.

Occurrence by Phase, Tularosa Cave.—Georgetown, 2.

VI. Clothing and Textiles

By ELAINE BLUHM

LIST OF SPECIMENS

	Tularosa Cave	Cordova Cave
Sandals		
Wickerwork	109	14
Plaited	91	3
Multiple warp	11	...
Continuous-outer-warp cord	2	...
Concentric-warp cord	8	8
Scuffer-toe	5	...
Leather	12	...
Moccasin	1	...
Cloth		
Plain over-one-under-one weave, cotton	19	...
Plain over-one-under-one weave, bast	11	...
Narrow fabric	...	1
Knotless netting	1	2
Coiled netting on warps	2	...
Netting	2	...
Twined cloth, bast, hard, and/or hair	2	1
Twined cloth, fur and/or feather cord	7	...
Basketry		
Coiled	28	10
Twilled	2	...
Tied-twined	1	...
Twined, flexible	1	...
Twined, rigid	...	3
Diagonal twined	...	3
Cradles		
Flexible	3	...
Rigid	1	...
Matting		
Twilled	7	...
Twined	6	1
String aprons	3	...
Sash	1	...
Burden strap	...	1
Pad	1	...

Discussion

Included in the collection of perishable artifacts from Tularosa Cave and Cordova Cave are many textile specimens: sandals, basketry, blankets, cloth, matting, cradles, and clothing. These specimens come from all levels, representing a time-span from the Pre-Pottery Phase through the Reserve–Tularosa phases and adding immeasurably to our knowledge of Mogollon textiles.

Some of the specimens resemble those from other sites in the Southwest and adjacent areas of the Great Basin and Texas, but the details of construction often vary. Therefore, on the basis of comparative study, it is now possible to draw some tentative conclusions about the chronological and geographical distribution of the various types of textile specimens in the Southwest and peripheral areas.

Textile Sandals

The largest single group of perishable textile artifacts is sandals. Altogether, 251 were recovered from all phases of occupation in both caves. These have been divided, on the basis of method of manufacture, into six major types and several subtypes.

WICKERWORK SANDALS

A total of 123 sandals are semi-rigid wickerwork, woven on two or four warps. While most of these sandals are of yucca leaves, a few are made entirely of heavy two-yarn cord, or have cord warps.

Two-warp wickerwork sandals (Figs. 87, center, right, 88, *b*, *c*) are those with two warp fibers, usually of crushed leaves, which are knotted at the heel in a square knot, tie again at the toe, and come up to form the toe tie when the sandal is complete. Over these two warps are woven whole or crushed leaves, in a plain over-one-under-one pattern. The end of the weft is wound around the knotted warps at the heel, thereby strengthening the heel of the sandal. Heel ties loop under the warps on either side and come forward to meet the toe tie over the instep. Another strip of yucca links the heel ties back of the heel.

A subtype of the two-warp wickerwork sandals is the frayed-sole variety (Figs. 87, left, 88, *a*) found in a Georgetown level of Tularosa Cave. It is similar in construction to the plain two-warp wickerwork type just described, but the weft elements pass over one warp, under the other, back over it, and under the first, where they are cut and the ends frayed out. The resulting frayed sole is much wider than the distance between the two warps.

Four-warp wickerwork sandals (Figs. 89, 90, center, right) are often more rigid than the two-warp type. The two pairs of warps on either side, made of whole or crushed yucca leaves, are knotted at the heel and extend beyond the length of the sandal at the toe. The weft elements are woven over-one-under-one across the warps. At the heel, the wefts are wrapped around the knotted warps. When the sandal is finished, warp elements extending beyond the toe are split, tied, and folded back over the toe, where they are often held in place by a thin piece of yucca that anchors them to the sole. The toe tie is an additional strip of yucca that is fastened through the sole, leaving a loop on top, and is knotted at the toe. Heel ties resemble those of the two-warp sandals in that they are fastened to the outer warp on either side of the heel and meet over the instep. Instead of the usual heel and toe ties, several sandals have side-loop ties, a series of loops along each side, which were laced together across the foot.

One fragment of a five-warp wickerwork sandal (Figs. 89, 90, left), from the Plain Ware level of Cordova Cave, is made of thin strips of yucca leaves. Weft elements are woven back and forth in a plain over-one-under-one weave across the warps.

In Tularosa Cave, wickerwork sandals are found in all levels from Pre-Pottery through the San Francisco-through-Tularosa mixed levels, but none occur in the pure Reserve–Tularosa levels. They are found in all three levels of Cordova Cave (Fig. 83). Wickerwork sandals appear to be the predominant type from Pre-Pottery through the San Francisco Phase, and after that seem to be of less importance. There is not enough evidence, at present, to discuss the relative popularity of the various wickerwork subtypes and their temporal significance. Two-warp and four-warp variations are contemporaneous. The two-warp, frayed-sole and the five-warp variations, each represented by only one specimen, were known at about the same time, that is, the Georgetown or Plain Ware Phase.

Wickerwork sandals resembling these are reported from other sites in the Mogollon area. One fragment of the four-warp variety comes from Sandal Cave (Harrington, 1928, p. 9) just east of the Reserve area. From Winchester Cave in southeastern Arizona Fulton (1941, p. 25) reports two-warp sandals that are similar in appearance but are described as twined, a variation not known in Tularosa or Cordova caves. Hough (1914, p. 84) found in Tularosa

Cave two-warp wickerwork sandals in which both warps are made by bending one leaf to form a loop, knotted at the heel. This variation was not found during the 1950 excavation, but it does resemble the Hohokam type (Haury, 1950, pp. 432–434). Cosgrove (1947, pp. 82–98) reports two-warp wickerwork sandals, identical with the type described here, from the caves of the Upper Gila. This type is identified as Pueblo, a statement that must be modified in the light of our present knowledge, as it is known as early as the Pre-Pottery Phase.

Two-warp wickerwork sandals of crushed yucca leaves are the predominant type from Ventana Cave (Haury, 1950, pp. 432–434). They are present in levels 1 to 4 of the midden, indicating that they may have been worn as early as San Pedro times (Haury, 1950, p. 340). While they closely resemble the plain two-warp wickerwork sandals from Tularosa Cave, they differ in structure: the warps of the Hohokam sandals are made of one continuous leaf, bent into an oval shape and knotted at the heel, while the Mogollon sandals are made of two leaves, knotted at both heel and toe and continued to form the toe tie. The structure of the Ventana Cave sandals is, therefore, closer to some fish-tail wickerwork sandals from the Hueco area than the predominant Mogollon type, although a few were reported by Hough from Tularosa Cave.

Wickerwork sandals are also found in sites in the Anasazi area. From Basketmaker II and III caves in northeastern Arizona, Kidder and Guernsey (1919, p. 158, Pl. 67), Guernsey (1931, p. 77, Pl. 90), and Baldwin (1938b, pp. 465–485) reported a few that have four warps and resemble the Mogollon type in outline and appearance, but the warps are fringed out at the toe, rather than folded back. From Betatakin, Judd reported (1931, pp. 63–64, Pl. 41) Pueblo III four-warp sandals that seem more like the Mogollon type. Haury (1945b, p. 42, Pl. 17) also reports a four-warp wickerwork sandal from the Pueblo III site of Painted Cave. Two-warp wickerwork sandals with frayed soles have been found in Pueblo III sites (Kidder and Guernsey, 1919, pp. 101–103). These are very like the frayed-sole specimen from the Georgetown level of Tularosa Cave in both construction and appearance. The warp pattern of these sandals is identical to that of the Mogollon two-warp type, in that the warps are made of two leaves, knotted at the heel.

Two-warp wickerwork sandals are also reported from Hermit's Cave (Ferdon, 1946, pp. 7–13) in the Guadalupe Mountains. Most of those sandals have the fish-tail heels, but in some cases the method of finishing the toes resembles that used in the ones from Tularosa Cave. In some, the toe tie is an extension of the warp, as it is in the plain two-warp wickerwork sandals described here; in others each warp is split in half beyond the toe and half of each is tied and the ends are folded back as in the Mogollon four-warp wickerwork type. Mera (1938, pp. 55–57) reports two- and four-warp wickerwork fish-tail sandals from the same area.

Two- and four-warp wickerwork sandals are found in the Hueco area of Texas (Cosgrove, 1947, pp. 82–87) and also in the Big Bend region (Howard, 1930, Pl. 34; Smith, 1933, pp. 57–66; Jackson, 1937, p. 154). In this area, however, the sandals usually have fish-tail heels, a variation unknown in the Reserve area, although two were reported from Doolittle Cave in the Upper Gila area by Cosgrove (1947, p. 93).

One two-warp wickerwork sandal resembling the Mogollon type in appearance is reported from Chihuahua, Mexico (Sayles, 1936, p. 74, Pl. 27).

In summary, the wickerwork technique used in the construction of coarse, semi-rigid sandals seems to be primarily a southern one, for sandals of that type are predominant in Mogollon sites, at least before the Reserve-Tularosa Phase, in Ventana Cave in the Hohokam area, and in Texas, although there are special manufacturing techniques peculiar to each region. While it is true that a few wickerwork sandals are found in the Anasazi area, they are not in the majority at any of the reported sites.

The Anasazi and Mogollon two-warp wickerwork sandals have similar warp patterns (both are made of two leaves, knotted at the heel and toe), and the four-warp sandals from the two areas are similar in appearance but differ in treatment of warps at the toe (in the Mogollon the warps are folded back, in the Anasazi they are fringed out). The two warps in the Hohokam sandals are made of one continuous leaf, and the two- and four-warp wickerwork types from Texas usually have fish-tail heels; neither of these variations is important in the Mogollon area.

On the basis of our present knowledge, it would seem that the wickerwork sandal technique is earlier in the Mogollon and Hohokam areas than elsewhere in the Southwest and its peripheries.

PLAITED SANDALS (FIGS. 91–96)

The second most important group comprises 94 plaited sandals. They are usually made of three or four whole or somewhat crushed yucca leaves, folded at the toe, and woven in an over-two-under-one or over-one-under-one diagonal pattern. The individual elements vary from 0.7 to 2.0 cm. in width in the predominant plaited type made of wide elements. The plaiting starts at the toe and extends beyond the desired finished length of the sandal. The surplus is then folded back over the heel, providing added cushioning. The toe tie is fastened under one of the elements and tied on top; the heel tie loops under the outside element on either side of the heel and ties on to the toe tie over the instep. A piece of yucca is tied across the back of the heel. One sandal of this type had side-loop ties (Figs. 91, 92, center). The sandals have square heels and round or square toes; in the former, lefts can sometimes be distinguished from rights.

A few plaited sandals (Figs. 95, 96) are made of narrow elements of strips of yucca leaves, 0.2 to 0.6 cm. wide. They are woven in the same manner, and both the round and square toe variations are present.

One plaited sandal was found in the Georgetown Phase of Tularosa Cave, and two come from the Plain Ware Phase of Cordova Cave, but most of them occur later (Fig. 83). They are present in San Francisco, are the predominant type in the San Francisco-through-Tularosa levels, and are the only type present in the pure Reserve–Tularosa levels. Only one was obtained from the Late Phase of Cordova Cave. Square-toed sandals are the most popular kind in all levels except the Georgetown, where the one specimen has a round toe, and in the Reserve–Tularosa, where the number of square- and round-toed sandals is the same. Sandals made of narrow elements are definitely in the minority in Tularosa Cave.

Plaited sandals, of wide elements, have been previously reported from other Mogollon sites. Hough (1914, p. 83) found some at Tularosa Cave. One was found at Sandal Cave, east of the Reserve area (Harrington, 1928, p. 9); three came from Winchester Cave in southeastern Arizona (Fulton, 1941, p. 26, fig. 5); and others came from caves of the Upper Gila area (Cosgrove, 1947, pp. 89–93). Cosgrove (p. 96) states that this is a Pueblo type, and while the term "Pueblo" is no longer appropriate, the evidence from sites of the Reserve area does confirm the fact that the period of greatest popularity of this type was coeval with Pueblo, that is, from the San Francisco through the Tularosa phases.

Plaited sandals also occur in Anasazi sites. In northeastern Arizona they are important in Pueblo III (Judd, 1931, pp. 63–64;

Morris, 1911, pp. 179–180; 1919, pp. 49–50; Pepper, 1920, pp. 93–94; Haury, 1945b, p. 42, Pl. 17; Fewkes, 1911, pp. 72–73, Pl. 31; Kidder and Guernsey, 1919, pp. 101–103; Fewkes, 1909, p. 47), although they are not the only type present at that time. These sandals are made of narrow elements and some have jog toes. The jog-toed type is unknown in the Mogollon area, and sandals made of narrow elements are scarce there. The plaited sandals from the southern Pueblo IV sites of Canyon Creek (Haury, 1934, pp. 64–66) and Camp Verde (Morris, 1929, pp. 85–86) are made of wide elements and closely resemble the most common type in the Reserve area.

In the Guadalupe Mountain area, Mera (1938, pp. 54–55), found two plaited sandals, made of wide elements, that represent about 1 per cent of all the sandals described in that report. One sandal of this type was reported from Chihuahua (Sayles, 1936, p. 74). Smith describes a diagonally woven sandal from the Carved Rock shelter in the Big Bend (V. J. Smith, 1938, p. 227) as unusual, but does not illustrate it, so the width of the elements is unknown.

In summary, it may be said that the technique of plaiting sandals was confined primarily to the Mogollon and Anasazi areas. Plaited sandals have not been reported from Hohokam sites, and are rare in the Guadalupe Mountain area and Texas. The majority of Mogollon plaited sandals can, however, be distinguished from the Anasazi, for the former are square- or round-toed, plaited of wide elements, while the latter have round or jog toes and are made of narrow elements. Sandals from the southern Anasazi sites of Canyon Creek and Camp Verde are Mogollon-type sandals, as are those from the Guadalupe Mountain area and Chihuahua. On the basis of present evidence, the technique of plaiting sandals first appears in the Georgetown and San Francisco phases in the Mogollon area. A letter from Earl H. Morris indicates that plaited sandals are present as early as Basketmaker III in the Anasazi area, although published reports suggest that the type was not popular there until Pueblo III. According to Morris, the earlier sandals are made of wider elements.

MULTIPLE-WARP CORD SANDALS

The 11 multiple-warp cord sandals from Tularosa Cave resemble types found in Basketmaker sites. Both warps and wefts are usually of two-yarn cord. Warps vary in number from 12 to 20, with the median at 16. Weft elements are usually woven across the warps in a plain over-one-under-one weave, except in one sandal which has a twined toe, and where the pattern is varied to reinforce the heel and toe of the sandal. Seven sandals have scallop toes (Figs. 97, 98), one has a round toe (Figs. 99, 100, right), and one a square toe (Figs. 99, 100, left). All have puckered heels produced by gathering the warps together and tying them, the ends of the warps then forming the ankle tie. Additional heel ties resemble those of the wickerwork sandals, and the toe tie consists of one or more strings fastened to the sole near the center of the foot a short distance back from the toe. A few multiple-warp sandals have side-loop ties, instead of the usual ankle and toe ties.

Multiple-warp cord sandals were few in number in Tularosa Cave, and none were found in Cordova Cave. There were six in Georgetown, four in San Francisco, and one in San Francisco-through-Tularosa levels (Fig. 83). The scalloped toe type predominates in all levels, although square- and round-toed types are present.

Multiple-warp cord sandals are characteristic of Basketmaker II and III and also are present in Pueblo III (Baldwin, 1938a, pp. 1–6). Fringed- and square-toed varieties are reported from Basketmaker II sites (Nusbaum, Kidder and Guernsey, 1922, pp. 73–80; Judd, 1926, p. 148; Guernsey, 1931, pp. 66–67; Kidder and Guernsey, 1919, p. 159), the scalloped toe type from Basketmaker III (Guernsey, 1931, p. 77, Pl. 9), and square-toed (Judd, 1926, p. 148) and jog-toed sandals (Kidder and Guernsey, 1919, pp. 103–105) are Pueblo III.

In a study of Basketmaker III sandals, Baldwin reported from 14 to 36 warps and an average ranging from 26 to 32 warps for the scalloped toe type most characteristic of that period (Baldwin, 1938b, p. 467). Only one sandal from Tularosa Cave has as many as 20 warps. Anasazi sandals also have knotted soles and colored decorations, variations not present in the Mogollon collection. Therefore, it seems that the Anasazi multiple-warp cord sandals are finer and more elaborate than the Mogollon.

On the basis of present evidence, the multiple-warp cord sandals seem to be an Anasazi development. The type appears earlier in the north, where it is first found in Basketmaker II, than in Tularosa Cave, where it appears during the Georgetown Phase. It is more abundant in Anasazi sites and is generally more complicated in weave and decoration. The scalloped toe variety, characteristic of Basketmaker III, is the most popular type in Tularosa Cave.

CONTINUOUS-OUTER-WARP CORD SANDALS

In two sandals from Tularosa Cave the two outer warps are formed of one cord. The inner warps consist of single-ply yarns looped over the outer warp and twisted to form two-yarn cord. One sandal, from the Pine Lawn period, had four warps when first constructed (Figs. 101, 102, right). Later, it had been repaired with strips of yucca leaves, replacing the string weft, and woven on only the two outer warps, as the inner warps had been worn out. The other sandal, from the San Francisco Phase, had eight warps (Figs. 101, 102, left). This one had a puckered heel, resembling that found in the multiple-warp cord sandals.

The continuous-outer-warp cord sandal with four warps may represent a variation of the wickerwork type prevalent at that period and the eight-warp one may be a variation of the multiple-warp type. It is also possible that both variations were experiments at blending Mogollon wickerwork techniques and Anasazi multiple-warp techniques. The type seems to be unique.

CONCENTRIC-WARP CORD SANDALS (FIGS. 103–106)

Sixteen 4-warp and 6-warp concentric, warp cord sandals were found in Tularosa and Cordova caves. The warps are made of two or three loops of string, one inside the other, tangent at toe and heel. Plain over-one-under-one weave is the pattern of the wefts. Toe ties fasten under the central warps; heel ties resemble those of the wickerwork sandals. These sandals are flexible and symmetrical. They were found throughout the cave, but always as a minor type. More were found in Cordova Cave, where the total sample collection is smaller, than in Tularosa Cave.

Concentric-warp cord sandals have been described by others working in the Mogollon area. Cosgrove (1947, pp. 91–97) reports a few from caves of the Upper Gila area. Hough (1914, p. 84) also found some in Tularosa Cave, but he describes a small projection on the heel formed by the ends of the wefts.

The type appears to be unique in the Upper Gila and Reserve areas, although Cosgrove (1947, p. 97) suggests that it has a counterpart in sandals reported from Pueblo I (Guernsey, 1931, p. 94, Pl. 57) and Pueblo III (Kidder and Guernsey, 1919, p. 103) sites in northeastern Arizona. The warps of the Anasazi sandals are formed by concentric loops of string, but the warps and wefts are made of heavier cord than those in the Mogollon sandals. The illustrated Anasazi sandals have pointed toes and either round or square heels. Heel ties differ from those of the Mogollon concentric-warp cord sandals as they occasionally are made of the ends of warps, and are, therefore, more like the multiple-warp cord sandal heel ties.

On the basis of present evidence, it would seem that the concentric-warp cord sandals described in this report are a unique Mogollon type. However, they may be related to the Anasazi variety, which is similar in warp pattern but different in heel and ties. The Mogollon variation covers a longer time span (from Pre-Pottery through Reserve–Tularosa) than that reported for the Anasazi sandals found in Pueblo I and III. As both are coeval with wickerwork sandals in their respective areas, they may represent a variation of the wickerwork type.

SCUFFER-TOE SANDALS

We found only five small sandals that might be considered scuffer-toe types. All were from Tularosa Cave. Three are wickerwork (Figs. 107, 108, right), one is plaited (Figs. 107, 108, left); both techniques were used in larger sandals. The fifth is woven over and under a continuous warp made by tying a string to form a circle (Figs. 107, 108, center). The tie on the wickerwork scuffer-toe is an additional part of the warps, knotted at the toe and tied again at the end of the toe loop. The toe tie on the continuous-warp variety is a sturdy loop of cord at the front edge of the toe. Heel ties on this sandal were cords fastened to the warps on either side and extending beyond the sandal, tying behind the heel.

Scuffer-toe sandals are reported by Cosgrove (1947, pp. 83–90) from the Hueco area. While none of Cosgrove's types correspond to those described here, the toe tie of the continuous warp type found in Tularosa Cave is the same as the toe ties from the Hueco area. Scuffer-toe sandals are late and unusual in the Reserve area, and may represent influence in San Francisco-through-Tularosa times from the Hueco area to the south.

SUMMARY (FIGS. 83, 84)

Wickerwork sandals are the predominant type in the Mogollon sites from Pre-Pottery until at least the San Francisco Phase. Concentric-warp cord sandals, always a minor type, are found in the same levels.

Plaited sandals, first introduced during the Georgetown Phase, tend to replace the wickerwork sandals during the Reserve–Tularosa Phase. Plaited sandals made of wide elements seem to be a southern variety. Those of narrow elements resemble Anasazi types and are to be found in San Francisco and San Francisco-through-Tularosa levels.

	WICKERWORK						PLAITED							MULTIPLE WARP CORD					CONTINUOUS OUTER WARP CORD			CONCENTRIC WARP CORD				SCUFFER TOE				TOTAL
	TWO-WARP, PLAIN I-A	TWO-WARP, FRAYED SOLE I-B	FOUR-WARP, PLAIN I-C	FIVE-WARP, PLAIN I-D	FRAGMENTS I-E	TOTAL	SQUARE TOE, WIDE ELEMENTS II-A	ROUND TOE, WIDE ELEMENTS II-B	FRAGMENTS, WIDE ELEMENTS II-C	SQUARE TOE, NARROW ELEMENTS II-D	ROUND TOE, NARROW ELEMENTS II-E	FRAGMENTS, NARROW ELEMENTS II-F	TOTAL	SCALLOP TOE III-A	SQUARE TOE III-B	ROUND TOE III-C	FRAGMENTS III-D	TOTAL	EIGHT-WARP IV-A	FOUR-WARP IV-B	TOTAL	FOUR-WARP V-A	SIX-WARP V-B	FRAGMENTS V-C	TOTAL	WICKERWORK VI-A	CONTINUOUS OUTER WARP CORD VI-B	PLAITED VI-C	TOTAL	
TULAROSA CAVE																														
RESERVE-TULAROSA							3 33.33	3 33.33	2 22.23	1 11.11			9 100																	9 100
SAN FRANCISCO-TULAROSA	4 4.49		9 10.11			13 14.60	25 28.10	11 12.36	28 31.48	4 4.49	1 1.12	1 1.12	70 78.67	1 1.12				1 1.12				1 1.12			1 1.12	3 3.37		1 1.12	4 4.49	89 100
SAN FRANCISCO	6 1463		13 31.71		1 2.44	20 48.78	3 7.32	1 2.44	6 14.62		1 2.44		11 26.82	3 7.32			1 2.44	4 9.76	1 2.44		1 2.44	4 9.76			4 9.76		1 2.44		1 2.44	41 100
GEORGETOWN-SAN FRANCISCO			5 100			5 100																								5 100
GEORGETOWN	14 4374	1 3.13	6 18.75		4 12.50	25 78.12		1 3.13					1 3.13	3 9.36	1 3.13	1 3.13	1 3.13	6 18.75												32 100
PINE LAWN-GEORGETOWN			1 100			1 100																								1 100
PINE LAWN	7 2258		22 70.96			29 93.54														1 3.23	1 3.23	1 3.23			1 3.23					31 100
PRE-POTTERY	9 50.00		6 33.33		1 5.56	16 88.89																2 11.11			2 11.11					18 100
TOTAL	40	1	62		6	109	31	16	36	5	2	1	91	7	1	1	2	11	1	1	2	8			8	3	1	1	5	226
CORDOVA CAVE																														
LATE	3 6000					3 60.00			1 20.00				1 20.00											1 20.00	1 20.00					5 100
PLAIN WARE	4 28.56		2 14.29	1 7.15		7 50.00	2 1429						2 1429									1 7.13	2 14.29	2 1429	5 35.71					14 100
PRE-POTTERY	1 16.67		3 50.00			4 66.67																		2 33.33	2 33.33					6 100
TOTAL	8		5	1		14	2		1				3									1	2	5	8					25
TOTAL BOTH CAVES	48	1	57	1	6	123	33	16	37	5	2	1	94	7	1	1	2	11	1	1	2	9	2	5	16	3	1	1	5	251

FIG. 83. Occurrence of sandal types by phases, Tularosa and Cordova caves.

Multiple-warp cord sandals, closely resembling the important Anasazi sandal type, were introduced during the Georgetown Phase; most of them are found in those levels, but they seem to last until the San Francisco and San Francisco-through-Tularosa phases.

The two continuous-outer-warp cord sandals, one from a San Francisco level and one from Pine Lawn, are unique in this area.

Scuffer-toe sandals, more important in the Hueco area, may represent contact with that area in the San Francisco and San Francisco-through-Tularosa periods.

Leather Sandals

Twelve leather sandals, all made of antelope hide, were found in Tularosa Cave. None were recovered from Cordova Cave.

LEATHER SANDALS, PLAIN (FIG. 109)

Three sandals from the Georgetown and Georgetown-through-San Francisco levels are modeled after cloth sandals. Leather pieces are cut in foot-shaped patterns, with rounded toe and heel, and wider at the toe than at the heel. The ties resemble those of the fabric sandals.

Plain leather sandals have been found in the Papago level of Ventana Cave (Haury, 1950, p. 427) and in a Basketmaker II site in northeastern Arizona (Kidder and Guernsey, 1919, p. 160). So few of this type have been reported in the Southwest that no definite conclusions can be drawn. The sandals probably occurred in both areas at the same time.

LEATHER SANDALS, SIDE-LOOP TIES (FIG. 110)

Nine of the leather sandals were the winter-type, oval-shaped pieces of leather, pulled up around the foot by a series of side-loop ties. Grass padding or "socks" line most of these. The sandals were found in Pre-Pottery, Pine Lawn, San Francisco, and San Francisco-through-Tularosa levels, but were more popular in the earlier period.

Side-loop winter sandals have also been reported from the Great Basin by Steward (1937, p. 53, fig. 23, *f*).

Moccasin

One moccasin fragment was obtained from a Pre-Pottery level in Tularosa Cave. While the specimen is too fragmentary to be

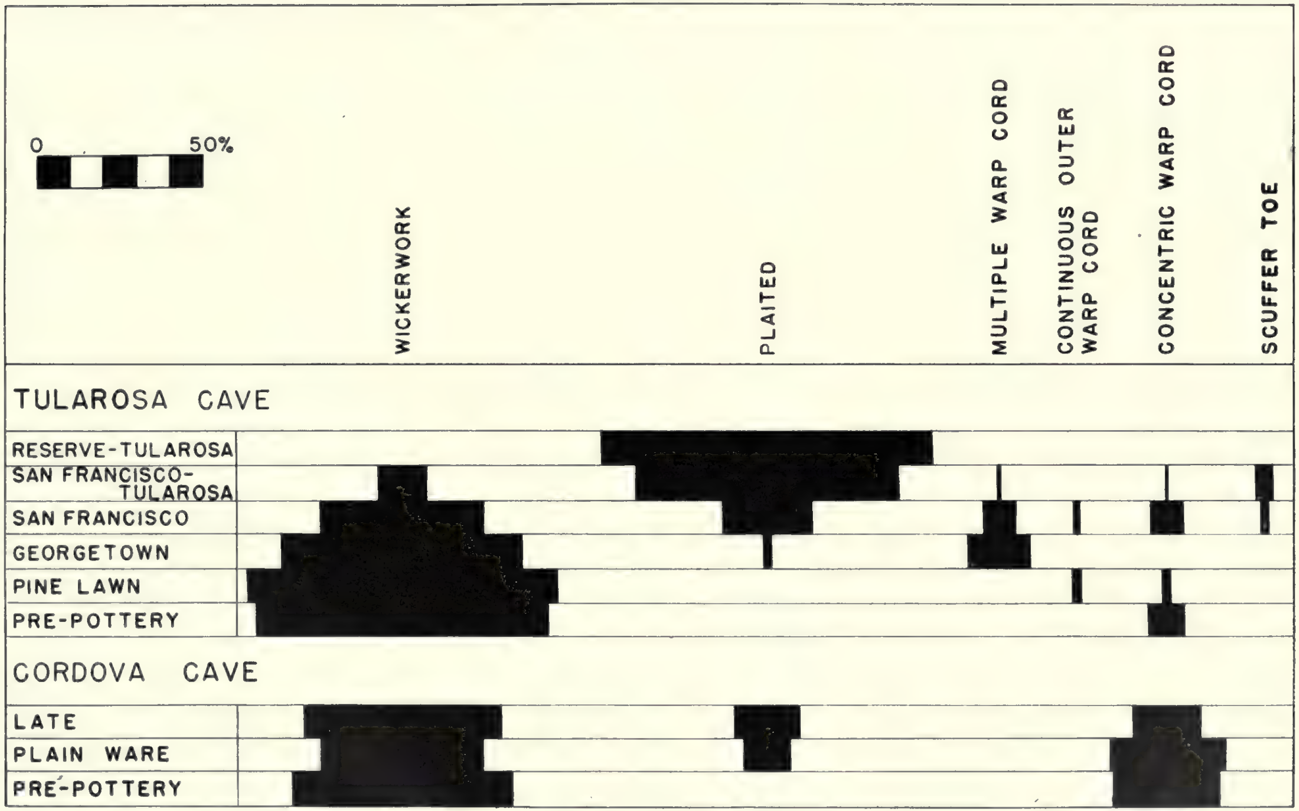


FIG. 84. Graph representing distribution of major sandal types by phases, Tularosa and cordova Caves.

compared as a type, the crimped edge and the leather thongs used in the sewing lead to the conclusion that it is a toe fragment.

Moccasins are rare in the Southwest, where sandals are the principal type of footgear. A few are reported from a Basketmaker II site (Guernsey, 1931, pp. 66–68) and Pueblo III sites (Kidder and Guernsey, 1919, p. 101; Fewkes, 1909, p. 51). A post-Columbian specimen was found at Pecos (Kidder, 1932, p. 303).

In the Great Basin moccasins are a more important type of footgear. They have been found in quantity at the Promontory caves (Steward, 1937, pp. 57–69), the Fremont River area (Morss, 1931, pp. 63–67), and Lovelock Cave (Loud and Harrington, 1929, pp. 47–48).

Cloth

Tularosa and Cordova caves yielded a total of 48 cloth fragments from all phases of occupation. Several types are included in this collection: plain over-one-under-one weave and twined cloth, and coiled and knotted netting fragments.

The Mogollon Indians used hard, bast, and surface fibers in the manufacture of textiles (see p. 215). Hard and bast fibers were used in cloth, netting, and sandals. Cotton was the only surface fiber found in any fabric in the cave and was used in plain woven cloth and netting. Bast and hard fibers were used in textiles before surface fibers, which are first found in the Georgetown Phase.

PLAIN OVER-ONE-UNDER-ONE WEAVE CLOTH

Most of the cloth fragments from Tularosa and Cordova caves were plain over-one-under-one weave fragments. They varied in quality; many resembled modern burlap and some were much finer. Only bast and surface fibers (cotton) were used, and the cotton cloth tended to be finer than the bast fiber cloth.

Plain woven cloth first appeared in the San Francisco Phase, although one cloth-impressed sherd was found in a Georgetown level, and a narrow fragment of fabric came from the Pre-Pottery level of Cordova Cave. Of the ten specimens found in the San Francisco levels, six were cotton and four were bast fiber. Ten specimens from the San Francisco-through-Tularosa mixed levels were cotton and seven were bast fiber; all three from the Reserve–Tularosa Phase were cotton. Most textile fragments were of natural color, but one cotton and one bast fragment were dyed red, and one cotton and two bast pieces were dyed black. A geometric design in black or dark brown, blue or green, and white was woven into one cotton specimen by using different-colored interlocking weft elements and varying the weave, skipping warps (Fig. 111).

Cosgrove (1947, pp. 69, 77–79) reported plain woven cotton cloth and some weft-wrapped open work specimens from the caves of the Upper Gila area. No cotton cloth was found in the Hueco area.

Plain over-one-under-one woven bast fiber cloth is first reported from Basketmaker II sites in the Anasazi area (Kidder and Guernsey, 1919, pp. 173–174), but plain woven cotton cloth does not appear until Pueblo I (Guernsey, 1931, p. 97). It is also reported from Pueblo II sites (Bartlett, 1934, pp. 46–47), and increases in popularity in Pueblo III (Kluckhohn and Reiter, 1939, p. 96; Haury, 1945b, p. 27; Kidder and Guernsey, 1919, p. 115; Morris, 1919, p. 48, and 1911, p. 179; Fewkes, 1909, p. 45, and 1911, p. 76; Judd, 1931, p. 63).

Hohokam people also made plain woven cotton cloth (Haury, 1950, pp. 450–451). During the Salado period Hohokam sites yield weft wrap openwork fabrics and gauze weaves (Haury, 1950, pp. 451–456; Fewkes, 1912, p. 148), which were also found at Canyon Creek (Haury, 1934, p. 91).

Plain over-one-under-one cloth was present in the three major areas of the Southwest. On the basis of present knowledge, it would appear that the weaving technique developed earlier in the North than in the South. Plain weave cotton cloth appeared at about the same time in both Mogollon and Anasazi areas. The complicated textiles found in late Hohokam sites are not present in Tularosa Cave, although Cosgrove reports some from the Upper Gila area.

KNOTLESS NETTING (FIG. 112, *c*)

One fragment of knotless netting came from a Georgetown level of Tularosa Cave, and two came from the Late Phase of Cordova Cave. Fragments have also been reported from Basketmaker II and Pueblo III sites in the Anasazi area (Kidder and Guernsey, 1919, pp. 117, 172–173) and from the Tonto Cliff Dwelling (Mott, 1935, p. 3), a Salado site. Apparently the technique is widespread in time and space.

COILED NETTING ON WARPS (FIG. 112, *a*)

Two fragments of coiled netting on warps came from the San Francisco and San Francisco-through-Tularosa levels of Tularosa Cave. Similar fabric has been reported by Cosgrove from Steamboat Cave in the Upper Gila area (Cosgrove, 1947, p. 72). No other examples have been found in the Southwest.

NETTING

Tularosa Cave yielded two netting fragments, one (from a Georgetown level) made of cotton tied with lark's head knots (Fig. 112, *d*), and one (from a Pine Lawn level) tied with overhand knots (Fig. 112, *b*).

A few Mogollon netting fragments are reported from the Upper Gila area by Cosgrove (1947, pp. 72–73), but the sheetbend is the only knot used in their construction.

Netting has been found in other areas of the Southwest and Texas. The sheetbend is the most frequently used knot. It has been reported from Basketmaker II (Guernsey and Kidder, 1921, pp. 77–79) and Pueblo IV (Haury, 1934, pp. 86–87) sites in the Anasazi area; from Ventana Cave (Haury, 1950, p. 399), although the lark's head was also used there; from Hermit's Cave in the Guadalupe Mountains (Ferdon, 1946, p. 17); and from the Hueco area (Cosgrove, 1947, pp. 72–73). The same knot is used in the Big Bend areas of Texas, although it has been incorrectly identified as a lark's head (Pearce and Jackson, 1933, Pl. 17, *e;* Holden, 1937, p. 61).

The sheetbend seems, therefore, to have been the common knot used in the construction of nets in the Southwest and Texas, although the lark's head was found at Tularosa Cave and, as a less important type, in Hohokam. The overhand knotted fragments from the Reserve area seem to be unique. On the basis of present knowledge, netting was known in the Anasazi area before it was present in Hohokam and Mogollon sites.

TWINED CLOTH, BAST, HARD, AND HAIR FIBER

A fragment of the top of a bag, made of bast fiber, with a geometric design woven in red and green (Fig. 113), and a piece of fabric with animal hair weft on one side, bast fiber weft on the other, and hard fiber warp were found in Tularosa Cave. Both occurred in the San Francisco Phase. The Late level of Cordova Cave yielded one fragment of twined cloth of bast fiber.

Cosgrove (1947, p. 70) also reports one twined fragment of a bag from Kelly Cave in the Upper Gila area.

These bag fragments closely resemble the twined bags reported from Basketmaker II and III sites (Kidder and Guernsey, 1919, pp. 172–173; Guernsey and Kidder, 1921, pp. 65–74; and Guernsey, 1931, pp. 79–80). Twined fabrics were also found in Pueblo III (Morris, 1919, p. 52; Kluckhohn and Reiter, 1939, p. 95) and Pueblo IV sites (Kidder, 1932, pp. 301–302).

Haury (1950, p. 410) reports only one twined bag fragment, made of cord, from Ventana Cave.

Twining, as a textile manufacturing technique, does not seem to be as important in the southern Mogollon and Hohokam areas as it is in the Anasazi area, where it first occurs. The Mogollon twined bags, reported from the Upper Gila and the Reserve areas, are both twined down to the right, as are the Anasazi bags, and may have been traded from the North.

TWINED FUR AND/OR FEATHER CORD CLOTH (FIG. 114)

Other twined textiles from Tularosa Cave were of fur and/or feather cord. A fur blanket fragment and a feather blanket fragment were found in Pine Lawn, associated with a burial. Three other fur blanket fragments were found in Georgetown and San Francisco levels and one other feather blanket came from the San Francisco-through-Tularosa mixed levels. All of these had fur or feather cord warps and string wefts. In a Georgetown level was found one fur and feather blanket which had fur cord warp and feather cord weft.

Cosgrove (1947, pp. 66–67) found fur cord and feather cord blankets in sites of the Upper Gila area. Feather cord blanket fragments were reported in Mogollon sites by Hough (1907, p. 24; 1914, p. 72).

Twined fur and feather cord blankets have been reported from many Anasazi sites. Fur cord blankets, more popular in the Basketmaker periods than later on, were found in Basketmaker II (Kidder and Guernsey, 1919, pp. 156, 174–175; Guernsey and Kidder, 1921, pp. 74–75; Guernsey, 1931, p. 65), Basketmaker III (Guernsey, 1931, p. 75), Pueblo I (Guernsey, 1931, pp. 92–93), and Pueblo III sites (Kidder and Guernsey, 1919, p. 118). Feather cord blankets are found in Basketmaker II (Kidder and Guernsey, 1919, pp. 174–175), Pueblo I (Guernsey, 1931, pp. 92–93), Pueblo III (Fewkes, 1911, p. 76; Morris, 1919, p. 47; Kluckhohn and Reiter, 1939, p. 95; Fewkes, 1909, p. 46; Morris, 1911, p. 179), and Pueblo IV sites (Kidder, 1932, p. 301; Haury, 1934, p. 37) but they are more popular in Pueblo III than before.

Fur cloth blankets, which probably date between A.D. 1000 and 1400, were reported from Ventana Cave (Haury, 1950, pp. 430–432).

In the peripheral areas of the Southwest, fur cord blankets were also known. They have been found in Gypsum Cave (Harrington, 1933, pp. 156–157) and Lovelock Cave (Loud and Harrington, 1929, pp. 50–53). Feather blankets also come from Lovelock Cave. Other fur blankets are reported from the Guadalupe Mountain area (Mera, 1938, p. 16) and the Hueco (Cosgrove, 1947, pp. 66–67) and Big Bend (G. C. Martin, 1933b, pp. 46–47) regions of Texas.

Fur cloth blankets and robes appear to have been known throughout the Southwest and peripheries. They seem to be as early in the Anasazi area as in the Mogollon, but they are later in the Hohokam. Feather cloth is reported from both Anasazi and Mogollon sites. Both fur and feather cloth are equally early in the Mogollon, and so few specimens are present that nothing can be said of their relative popularity at various periods. However, a study of fragments of fur and feather cordage (see p. 212) reveals that fur cord decreases from early to late while feather cord increases. In the Anasazi sites, fur cloth is more important in earlier times while feather cloth is more important later on. The Tularosa Cave fur and feather cord blanket, with fur cord warp and feather cord weft, seems to be a unique type.

SUMMARY (FIG. 85)

Plain woven textiles first appear in the form of a narrow fabric in the Pre-Pottery Phase of Cordova Cave, but loom woven textiles of cotton and bast fibers are not found before the San Francisco Phase.

Knotless netting, a technique known from other Southwestern sites, is found in the Georgetown level of Tularosa Cave and in the Late Phase of Cordova Cave. Coiled netting on warps is reported only in the Mogollon area.

Only two netting fragments were found in Tularosa Cave: one tied with overhand knots, from the Pine Lawn Phase, and another tied with lark's head knots, from the Georgetown Phase. The use of the lark's head knots makes this piece different from the majority of Southwestern netting tied with sheetbends.

Twined cord cloth is late in the Mogollon area, occurring only in the San Francisco Phase of Tularosa Cave and the Late Phase of Cordova Cave. Fragments resemble Anasazi specimens and may be trade items from the North.

Fur cord blankets are found in the Pine Lawn, Georgetown, and San Francisco phases of Tularosa Cave, and feather blankets come

	BASKETRY										CLOTH												
	COILED																						
	TWO ROD AND BUNDLE	BUNDLE WITH ROD CORE	BUNDLE	HALF ROD AND BUNDLE	TOTAL	TWILLED	TIED-TWINED	TWINED, FLEXIBLE	TWINED, RIGID	TOTAL, BASKETRY	PLAIN OVER-ONE-UNDER-ONE WEAVE CLOTH, COTTON	PLAIN OVER-ONE-UNDER-ONE WEAVE CLOTH, BAST FIBER	NARROW FABRIC, PLAIN OVER-ONE-UNDER-ONE WEAVE	KNOTLESS NETTING	COILED NETTING ON WARPS	NETTING-LARK'S HEAD KNOTS	NETTING-OVERHAND KNOTS	TWINED CLOTH--BAST FIBER	TWINED CLOTH--BAST, HARD, AND HAIR FIBER	TWINED CLOTH--FUR CORD	TWINED CLOTH--FEATHER CORD	TWINED CLOTH--FUR AND FEATHER CORD	TOTAL, CLOTH
TULAROSA CAVE																							
RESERVE-TULAROSA						1 100				1 100	3												3
SAN FRANCISCO-TULAROSA	4 57.13		1 14.29	1 14.29	6 85.71	1 14.29				7 100	10	7			1						1		19
SAN FRANCISCO	3 60.00	1 20.00		1 20.00	5 100					5 100	6	4			1			1	1	1			14
GEORGETOWN-SAN FRANCISCO	1 25.00		1 25.00	2 50.00	4 100					4 100													
GEORGETOWN	2 100				2 100					2 100				1		1				2		1	5
PINE LAWN	3 60.00	1 20.00			4 80.00			1 20.00		5 100							1			1	1		3
PRE-POTTERY	6 75.00	1 12.50			7 87.50		1 12.50			8 100													
TOTAL	19	3	2	4	28	2	1	1		32	19	11		1	2	1	1	1	1	4	2	1	44
CORDOVA CAVE																							
LATE		1 20.00		1 20.00	2 40.00				3 60.00	5 100				2				1					3
PLAIN WARE	6 85.71			1 14.29	7 100					7 100													
PRE-POTTERY				1 100	1 100					1 100			1										1
TOTAL	6	1		3	10				3	13			1	2				1					4
TOTAL BOTH CAVES	25	4	2	7	38	2	1	1	3	45	19	11	1	3	2	1	1	2	1	4	2	1	48

FIG. 85. Occurrence of basketry and cloth by phases, Tularosa and Cordova caves.

from Pine Lawn and San Francisco-through-Tularosa levels. The fur-and-feather blanket from a Georgetown level is unique.

Basketry

A total of 45 basketry specimens, primarily wall fragments, came from all phases of Tularosa and Cordova caves. Coiled, twilled, and twined pieces indicate that several techniques were known to the Mogollon.

COILED BASKETRY (FIGS. 115–117)

Coiled basketry was present in all phases of occupation of the caves and comprises 85 per cent of the collections. Several different types of foundations were found in the coiled fragments. The two-rod-and-bundle-bunched foundation, with non-interlocking stitches, is the most common type throughout.

All other foundation types are in the minority. The Cordova Cave collection suggests that the half-rod-and-bundle foundation was known throughout the Mogollon sequence, while it occurred in only Georgetown-through-San Francisco, San Francisco, and San Francisco-through-Tularosa levels of Tularosa Cave. The bundle-with-rod-core foundation is found early, in the Pre-Pottery and Pine Lawn phases, and late, in the San Francisco Phase of Tularosa Cave and the Late Phase of Cordova Cave. Bundle foundation is present only in Georgetown-through-San Francisco and San Francisco-through-Tularosa levels of Tularosa Cave.

In the Upper Gila area, the two-rod-and-bundle type is the most important; single rod and bundle-with-rod-core types were also found by Cosgrove (1947, pp. 99–105).

Coiled basketry was well developed in the Anasazi area. Specimens have been found in sites from Basketmaker II on. The two-rod-and-bundle foundation persists throughout the Basketmaker and Pueblo periods and has been reported from many sites (Morris and Burgh, 1941, p. 12). Bundle-with-rod-core is reported from Dupont Cave, a Basketmaker II site (Nusbaum, Kidder, and Guernsey, 1922, p. 96). Bundle foundation occurs in Basketmaker III (Morris and Burgh, 1941, p. 10) and Pueblo IV (Haury, 1934, p. 74). Half-rod-and-bundle foundation is found in Pueblo III (Morris and Burgh, 1941, p. 11).

More coiled basketry was found in Ventana Cave than any other type (Haury, 1950, pp. 403–407). At that site, however, bundle-with-rod-core, bundle, and single rod types predominate, instead of the two-rod-and-bundle type. However, all four foundations are known equally early in that area and may date from as far back as the San Pedro period.

In the Hueco area, bundle, bundle-with-rod-core, two-rod-and-bundle, and half-rod-and-bundle are among the types present (Cosgrove, 1947, pp. 99–105).

Bundle foundation is the predominant coiled basket foundation in the Big Bend region of Texas (Setzler, 1932, p. 138; G. C. Martin, 1933b, pp. 55–56; Pearce and Jackson, 1933, pp. 106–114; Jackson, 1937, p. 151; Quinn and Holden, 1949, p. 129). The same type is present in the Guadalupe Mountain area (Mera, 1938, Pl. 14) although the two-rod-and-bundle type is also found there.

Coiled basketry is late and not as prevalent in the Great Basin area. Fragments with single rod foundation were found at Lovelock Cave (Loud and Harrington, 1929, p. 65) and two-rod-and-bundle foundation fragments were reported by Morss (1931, p. 73) from the Fremont area. Single rod, two-rod-and-bundle, and one-rod-and-bundle types were also found in the Promontory caves (Steward, 1937, pp. 33–34).

Coiled basketry seems to be the predominant type in the Southwest, where it is found in early as well as late sites and levels. The two-rod-and-bundle foundation, most important in the Anasazi and Mogollon areas, is known to the Hohokam but is not as popular in that area as the bundle and single rod types. These types are also important in the Hueco and Big Bend areas of Texas. On the basis of our present knowledge, coiled basketry was known earlier in the southern Mogollon and Hohokam areas than in the northern Anasazi region.

TWILLED BASKETRY (FIG. 118)

Only two fragments that could be identified as pieces of twilled-ring baskets were found in Tularosa Cave. One occurred in the San Francisco-through-Tularosa mixed level and the other in a Reserve–Tularosa level.

Twilled baskets are first reported from Basketmaker II sites (Guernsey and Kidder, 1921, p. 63), although the earliest ring baskets are Pueblo I (Morris and Burgh, 1941, p. 19). The technique is more important in Pueblo III times (Kidder and Guernsey, 1919, pp. 108–110; Morris, 1919, p. 56; Judd, 1931, pp. 64–65; Haury, 1945b, p. 43) and Pueblo IV (Kidder, 1932, pp. 298–299; Haury, 1934, pp. 72–73). Twilled basketry was also present in Ventana Cave (Haury, 1950, p. 402).

The technique of twilling is more important in the Anasazi area than in the Hohokam and Mogollon regions, and it is found earlier in the North than in the South.

TWINED BASKETRY

Twined basketry is an early trait in the Mogollon area. A tied-twined basket with heavy grass bundle foundation (Fig. 119) was found in a Pre-Pottery level and a flexible, cylindrical carrying basket of yucca leaves, twined together with yucca strips (Fig. 120), occurred in a Pine Lawn level of Tularosa Cave. Rigid twined basket fragments are found in the Late levels of Cordova Cave (Fig. 121, top).

Cosgrove (1947, p. 112) reports a flexible twined basket of bear grass leaves from Mule Creek Cave in the Upper Gila area.

Twined basketry is relatively rare in the Anasazi area. Nusbaum, Kidder, and Guernsey (1922, Pl. 34) illustrate a tied-twined cist lining from a Basketmaker II cave in Kane County, Utah, similar to the tied-twined basket from Tularosa Cave. They also illustrate a twined mat made into a basket or cradle that resembles the twined yucca carrying basket described above (Nusbaum, Kidder, and Guernsey, 1922, pp. 98–102). Another twined carrying basket was found in Painted Cave (Haury, 1945b, p. 41, Pl. 16).

SUMMARY (FIG. 85)

Coiled basketry is the predominant type in the Mogollon area, as in the Hohokam and Anasazi regions. Two-rod-and-bundle foundation is found from Pre-Pottery through the San Francisco-through-Tularosa levels, and it is the major type. Half-rod-and-bundle and bundle-with-rod-core foundations cover the same time span, but are less important. Bundle foundation is found in Georgetown-through-San Francisco and San Francisco-through-Tularosa levels.

Twilled basketry is late in Tularosa Cave, as it is found only in the San Francisco-through-Tularosa and Reserve–Tularosa levels.

Tied-twined basketry occurs in the Pre-Pottery Phase and flexible twined basketry is found in the Pine Lawn Phase. In the Late level of Cordova Cave fragments of rigid twined basketry were found.

Cradles

Four cradles and cradle fragments were found in Tularosa Cave; three were flexible and one was rigid.

FLEXIBLE CRADLES (FIG. 122)

One complete flexible cradle and fragments of two others were found in Pre-Pottery, Pine Lawn, and Georgetown levels. They were made of sotol leaves laid parallel to one another and fastened together by strips of yucca leaves woven in a twined weave. At the top and bottom the rushes were closer together than in the middle. This mat-like framework was then rolled together and the ends and tangent sides were closed by a yucca net. The complete specimen contained a thick bedding of grass.

Cosgrove (1947, pp. 117–118) found a flexible cradle in Steamboat Cave in the Upper Gila area.

Similar cradles, or cradle-like carrying baskets, have been found in Basketmaker II sites in the Anasazi area (Kidder and Guernsey, 1919, pp. 165–166; Guernsey and Kidder, 1921, p. 58; Nusbaum, Kidder, and Guernsey, 1922, pp. 98–102).

Flexible twined cradles appear to be earlier in the Mogollon area than in the Anasazi, on the basis of present information.

RIGID CRADLES (FIG. 123)

In a San Francisco-through-Tularosa level a fragment of what is perhaps a rigid cradle was found. It consisted of a series of parallel sticks bound together and fastened at right angles to two sticks.

Similar rigid cradles are reported from Basketmaker sites in northeastern Arizona (Kidder and Guernsey, 1919, p. 164; Guernsey, 1931, p. 58). On the basis of very few specimens, it would seem that in the Mogollon area the flexible cradles appear before the rigid type; in the Anasazi area they are contemporaneous.

Matting

Tularosa Cave yielded a total of thirteen mat fragments, seven twilled and six twined and sewed. One twined and sewed fragment came from Cordova Cave.

TWILLED MATTING (FIGS. 124, 125)

Twilled matting fragments were made of yucca or rushes, woven in an over-two-under-two or over-three-under-three pattern. One came from Georgetown, one from San Francisco, four from San Francisco-through-Tularosa, and one from the Reserve–Tularosa.

Twilled matting is widespread. Some specimens have been found in Texas (Setzler, 1932, p. 138; Coffin, 1932, p. 36; G. C. Martin, 1933b, Pl. 61). In the Anasazi area it appears to be most popular in Pueblo III (Morris, 1911, p. 179, and 1919, pp. 53–54; Kidder and Guernsey, 1919, pp. 111–112; Judd, 1926, pp. 97–98; Tschopik, 1939, p. 94; Haury, 1945b, p. 48), although fragments have been found in Pueblo IV (Kidder, 1932, p. 300; Haury, 1934, p. 81) and Basketmaker II caves (Kidder and Guernsey, 1919, pp. 170–171). The over-two-under-two and over-three-under-three patterns are known there as well as the more complex patterns.

In the Hohokam area, Gladwin reports over-two-under-two plaited matting impressions from the Sacaton Phase at Snaketown (Gladwin, Haury, Sayles, and Gladwin, 1937, p. 159).

Twilled matting, occurring later than the twined, is found in Hohokam, Anasazi, Mogollon, and Texas sites. Greater variation in pattern has been reported from Anasazi sites than is known in the others.

TWINED AND SEWED MATTING (FIG. 126)

Twined and sewed matting was the earliest type found in Tularosa Cave. One specimen came from a Pine Lawn level, and five from the Georgetown levels. In the Late level of Cordova Cave another specimen was found. Elements consist of bunches of three rushes, twined together along the edges with string and sewed together across the center.

Plain twined mats, resembling the twined and sewed type, are a widespread trait, occurring in the Anasazi area (Nusbaum, Kidder and Guernsey, 1922, pp. 98–102; Guernsey and Kidder, 1921, p. 97), in the Guadalupe Mountain area (Ferdon, 1946, pp. 15–16), in the Great Basin (Steward, 1937, pp. 29–32; Loud and Harrington, 1929, pp. 56–60), and in Texas (Jackson, 1937, p. 157). Twined and sewed mats are more unusual. They have been reported by Cosgrove (1947, p. 114) from the Upper Gila area, and they occur in Texas (Pearce and Jackson, 1933, pp. 105–106). One specimen was found in the Twenty-nine Palms region in the Great Basin (Campbell, 1931, p. 68). The only specimen from the Anasazi area came from a Pueblo III site (Tschopik, 1939, pp. 94–95).

Twined and sewed matting may be a less important variation of the twined matting that is a widespread early trait found throughout the Southwest and peripheral areas. Only occasional examples of twined and sewed mats are reported. They are early in Mogollon, and are also found in Texas and the Great Basin, and late in the Anasazi area.

String Aprons (Fig. 127)

One complete string apron and fragments of two others were found in Tularosa Cave. The complete apron, from the Georgetown Phase, was made of two series of loops of string, both bound together at one point by additional string.

One fragment (Fig. 127, lower left) from a San Francisco-through-Tularosa level, consisted of a group of strings that had been doubled. The doubled ends had then been folded over and bound together. This apron was dyed red.

The other apron fragment (Fig. 127, upper left) consisted of a group of doubled cords folded over a heavier cord and held in place by twined elements. The loose ends of the string hung down below the heavier cord or belt. This specimen was found in a Georgetown level.

String aprons which are twined together occur in Basketmaker II and III sites (Kidder and Guernsey, 1919, p. 157; Guernsey, 1931, p. 65). Similar aprons are reported from Ventana Cave (Haury, 1950, p. 429), the Big Bend area (G. C. Martin, 1933b, pp. 43–45), and the Great Basin (Loud and Harrington, 1929, p. 53).

One string apron with elements bound together came from Canyon Creek (Haury, 1934, pp. 63–64).

String aprons are a common type of clothing in the Southwest, Texas, and the Basin. They occur at about the same time all over the area.

Sash (Fig. 128)

A sash, made of a hank of cord, twisted to form a rope, with finer cords tied through the loops at either end, was found around the waist of mummy No. 2, in the Pine Lawn Phase of Tularosa Cave. A similar sash has been reported from a Basketmaker II site in northeastern Arizona (Kidder and Guernsey, 1919, p. 157).

Burden Strap (Fig. 129, top)

A semi-flexible burden strap fragment, made of bear grass (*Nolina*) warps and cord wefts, was recovered from the Plain Ware level of Cordova Cave. At one end the warps were folded over a thin stick and held in place by weft elements twined across them, catching both the folded ends and the main part of the warps.

The treatment of the end of the strap resembles that of Basketmaker burden straps from Grand Gulch, Utah. Although the Basketmaker straps are made of cloth, the ends are folded over small sticks and stitched down to hold them in place.

Pad (Fig. 129, bottom)

A rectangular pad was recovered from the San Francisco-through-Tularosa mixed level of Tularosa Cave. Five bundles of short strings were tied-twined together and then the entire pad was bound together. There is no indication of the use of this object.

Summary and Conclusions

In summary, the discovery and analysis of the perishable textile material from Tularosa Cave now makes it possible to discuss similarities and differences in the textile material of the three Southwestern cultures.

Because there is more information on sandals than on any of the other textiles, they furnish the most interesting comparisons. The wickerwork sandals are the earliest in Mogollon and they are the predominant type there from the Pre-Pottery through the San Francisco phases. They occur very rarely in Anasazi; a few are reported from Basketmaker III, and although they are more popular in Pueblo III, they do not predominate. Wickerwork is the most popular technique at Ventana Cave and may be dated from San Pedro on, at that site. As the wickerwork technique is also important in the manufacture of sandals in Texas, it would seem that the technique is of southern rather than northern origin. Mogollon wickerwork sandals can be distinguished from those of the other areas.

Woven cord sandals, which are the predominant type in Basketmaker II and III, are found in Tularosa Cave in the Georgetown, San Francisco, and San Francisco-through-Tularosa levels; and the main type is the scalloped toe, which is characteristic of Basketmaker III. None of the fringed-toe, knotted-sole, or colored types are present in Mogollon. This type is more important and more highly developed in the North.

	LEATHER SANDALS			CRADLES		MATTING		STRING APRONS				
	PLAIN	WINTER TYPE	MOCCASIN	FLEXIBLE	RIGID	TWILLED	TWINED AND SEWED	ELEMENTS BOUND	ELEMENTS TWINED	SASH	BURDEN STRAP	PAD
TULAROSA CAVE												
RESERVE - TULAROSA						1						
SAN FRANCISCO-TULAROSA		1			1	4		1				1
SAN FRANCISCO		1				1						
GEORGETOWN - SAN FRANCISCO	1											
GEORGETOWN	2			1		1	5	1	1			
PINE LAWN		1		1			1			1		
PRE - POTTERY		6	1	1								
TOTAL	3	9	1	3	1	7	6	2	1	1		1
CORDOVA CAVE												
LATE							1					
PLAIN WARE											1	
PRE - POTTERY												
TOTAL							1				1	
TOTAL BOTH CAVES	3	9	1	3	1	7	7	2	1	1	1	1

FIG. 86. Occurrence of miscellaneous leather and woven articles by phases, Tularosa and Cordova caves.

Plaited sandals, which first appear in Georgetown times and predominate in the Reserve–Tularosa period, are popular in the Pueblo III period of Anasazi. The narrow elements and fine plaiting of the northern part of the Anasazi area are not characteristic of the Mogollon sandals, which are coarser and resemble those from the Sierra Ancha and Camp Verde region.

The concentric-and continuous-outer-warp cord sandals are few in number, but may represent experimental variations or blends of the types described above.

The few scuffer-toe types also provide inconclusive evidence, but suggest some contact with the Hueco area in Texas in late San Francisco and Reserve–Tularosa times.

Leather sandals and moccasins are definitely in the minority in the Mogollon area, as they seem to be elsewhere in the Southwest.

All three cultures produced plain over-one-under-one woven cloth. Woven cloth may be slightly later in Mogollon than in Anasazi, as it does not appear until San Francisco times or, at the earliest, Georgetown times, as suggested by one cloth-impressed sherd. Twined bags appear to be primarily an Anasazi trait; the one decorated fragment in Tularosa Cave comes from a San Francisco-through-Tularosa level. Haury reports one bag from Ventana Cave. In Anasazi sites, twined bags are most important in Basketmaker III.

Fur cord and feather cord blankets appear in both Anasazi and Mogollon, while our present knowledge of the Hohokam indicates only fur cord robes. The fur and feather cord specimen from Tularosa Cave is unique in the area. These robes first appear at about the same time in both the Mogollon and Anasazi areas.

Coiled basketry seems to be the predominant type in the Southwest, as it is the most important type in all three major cultures. Two-rod-and-bundle, bunched foundation, however, is predominant only in Anasazi and Mogollon; bundle, bundle-with-rod-core, and single rod foundations are more important in Hohokam. These types were also known to the Mogollon and Anasazi. As the Pre-Pottery levels of Tularosa and Cordova caves and the San Pedro levels of Ventana Cave antedate Anasazi sites, the first coiled basketry comes from the southern area.

Twilled basketry and matting are also present in all three cultures. Haury reports basketry from Ventana Cave and twilled matting is reported at Snaketown. Some twilled baskets are reported from Basketmaker II, although most pieces come from Pueblo III sites. Twilled baskets and/or mats would seem to have appeared at about the same time in both Anasazi and Mogollon.

Twined matting is found early, occurring in Basketmaker II sites in the Anasazi area, and in Pine Lawn in Mogollon (Fig. 86). The tied-twined basket, found in the Pre-Pottery Phase, antedates any reported from Anasazi sites.

Information on cradle types is scarce, but one rigid type and the flexible type reported from Anasazi sites are also known to the Mogollon. In the Mogollon area it would appear that the flexible type precedes the rigid; in the Anasazi area they seem to be the same age.

The construction of string aprons and sashes varies considerably from specimen to specimen. It would seem, however, that the general technique of twining elements together in the aprons prevailed throughout the Southwest. The one sash reported from Tularosa Cave is simpler in construction than most of the Anasazi and Hohokam sashes reported in the literature.

Description

Textile Sandals

WICKERWORK SANDALS

A. Two-warp wickerwork sandals, plain (Figs. 87, center and right, 88, *b*, *c*).

Material.—Warps, wefts, and ties are usually made of yucca leaves (*Yucca baccata* Torr.) that have been mashed before they are woven, to make them more pliable. Usually the mashed leaves are woven without further treatment, but in one sandal they were first loosely twisted to form a coarse, crude cord. Two sandals have two-yarn cord warps and ties, and one has only cord ties.

Manufacture.—The warp elements are tied at the heel in a square knot and brought down to the toe, where, after the sole has been completed, they are tied again. Weaving is begun at the heel, and the weft goes back and forth under and over the warp. The end of the weft is frequently wound around the knotted warp at the heel before the sole is started, and is sometimes wound around the knotted warp at the toe when the sandal has been completed. As additional weft strands are added during the course of weaving, the ends are left on the under side of the sandal, where they fray

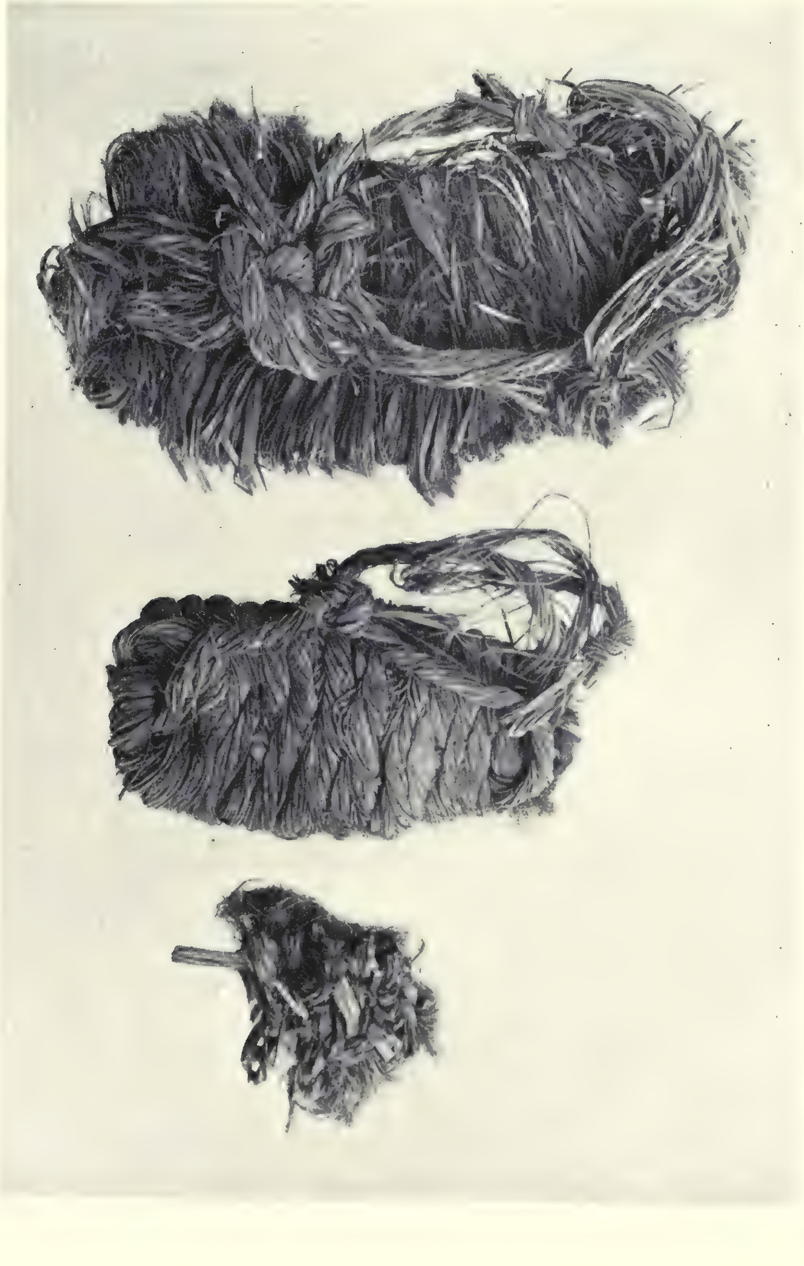


Fig. 87. Two-warp wickerwork sandals: left, frayed sole variety; center and right, plain. Length of center sandal, 16.7 cm.

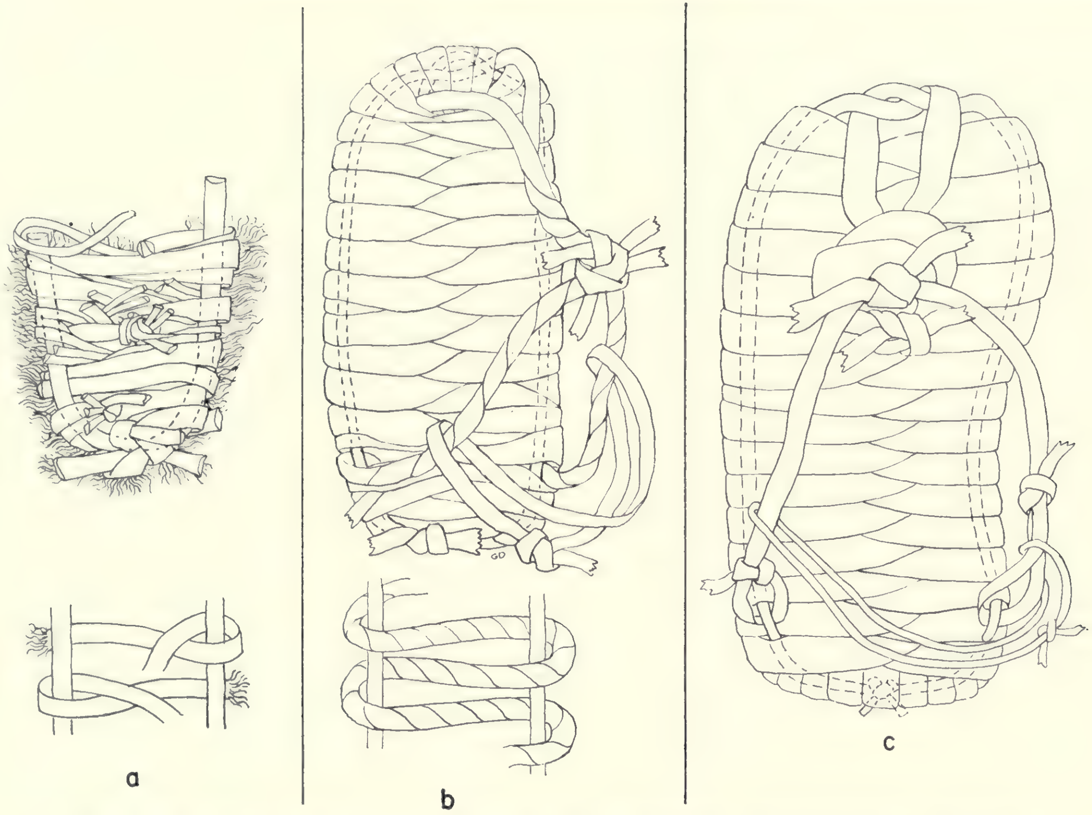


FIG. 88. Drawings showing construction of two-warp wickerwork sandals shown in Figure 87.

out, providing additional cushioning for the sole. These sandals are oval and symmetrical; lefts cannot be distinguished from rights.

Ties.—The ends of the warp elements are knotted at the toe and brought up on top of the sandal. The toe tie is formed when they are firmly knotted again from 3 to 5 cm. back from the toe.

The heel tie is fastened under the warp on either side from 2 to 4 cm. from the back of the sandal. The tie is often made of one piece of yucca, which is taken under the warp on one side, looped around itself, taken across the sole at the back of the heel, under the warp on the other side, and looped around itself. Then both ends are brought forward and knotted over the instep. A variation of the heel tie is made of two pieces of yucca, which are inserted through the sole and under the warp, one on either side. Each is looped around itself as it is brought forward, and the two are tied together over the instep. A third strip of yucca connects the two across the back of the heel. In both variations, the knotted heel ties extend down over the instep and are tied to the toe loop.

Occurrence by Phases, Tularosa Cave.—Pre-Pottery, 9 (6 fragmentary); Pine Lawn, 7 (1 fragmentary); Georgetown, 14 (4 fragmentary); San Francisco, 6 (all fragmentary); San Francisco-through-Tularosa, 4 (3 fragmentary).

Occurrence by Phases, Cordova Cave.—Pre-Pottery, 1; Plain Ware, 4 (2 fragmentary); Late, 3 (1 fragmentary).

Dimensions.—Length, 10.5–32.0 cm. (average 19.4 cm.); width, 5.4–13.4 cm. (average 9.1 cm.).

B. Two-warp wickerwork sandal, frayed sole (Figs. 87, left, 88, *a*).

Material.—Warps and wefts are of whole yucca leaves (*Yucca baccata* Torr.), which do not appear to have been treated before weaving.

Manufacture.—Warp elements are tied in a square knot at the back of the heel and are brought forward and left about 4 cm. apart, less than the width of the sole of the sandal. Weft elements go from the top of one warp under the other, back over it, and under the first. At this point the element is cut and the end frayed out. The frayed ends of the weft elements produce a soft cushion for the sole and extend out on either side, so that the completed sandal is considerably wider than the distance between the two warp elements.

Ties.—No heel or toe ties are present.

Occurrence by Phase, Tularosa Cave.—Georgetown, 1 (fragment).

Dimensions.—Length, incomplete; width, 10.0 cm.

C. Four-warp wickerwork sandals, plain (Figs. 89, 90, center, right).

Material.—Warp strands are usually whole yucca leaves or strips of whole leaves (*Yucca baccata* Torr.). In a few sandals warps are heavy two-yarn hard fiber cords. Weft elements are usually narrow strips of yucca leaves, but two-yarn cord and loosely twisted fiber are also used.

Manufacture.—Weft elements are woven over-one-under-one in plain weave, back and forth across the four warp elements, which are anchored at the heel by wrapping them around several weft strands. When the sandal is the desired length, the part of each warp that extends beyond the length of the sole at the toe is split longitudinally into two pieces, one narrower than the other. The narrower portions of each of the two warps on either side are tied together to keep the wefts from raveling. All the warp elements are then folded back over the top of the sandal. Occasionally they are braided or bound to the sole with a strip of yucca leaf.

Ties.—The heel tie is fastened under the outer warp on either side about 2 to 4 cm. from the back of the sandal. The tie consists of a strip of yucca, which is taken under the warp on one side, looped around itself, taken across the sole at the back of the heel, passed under the warp on the other side, and looped around itself. Both ends are brought forward and tied around the ankle.

The toe tie consists of a strip of yucca inserted above one of the two center warps and below the weft. The tie forms a loop 2 or 3 cm. back from the toe, is taken under the weft on top of the other center warp, and both ends are tied at the toe.

Four sandals of this type have side loops consisting of strips of leaves or cords tied to the outer warps at intervals along the outer edges of the sandal. The one complete specimen of this type has four loops on each side. String or strips of leaves connecting these loops are laced back and forth across the top of the foot.

Occurrence by Phases, Tularosa Cave.—Pre-Pottery, 6 (5 fragmentary); Pine Lawn, 22 (16 fragmentary); Pine-Lawn-through-Georgetown, 1 (complete); Georgetown, 6 (fragments); Georgetown-through-San Francisco, 5 (4 fragmentary); San Francisco, 13 (12 fragmentary); San Francisco-through-Tularosa, 9 (fragments).

Occurrence by Phases, Cordova Cave.—Pre-Pottery, 3 (fragments); Plain Ware, 2 (fragments).

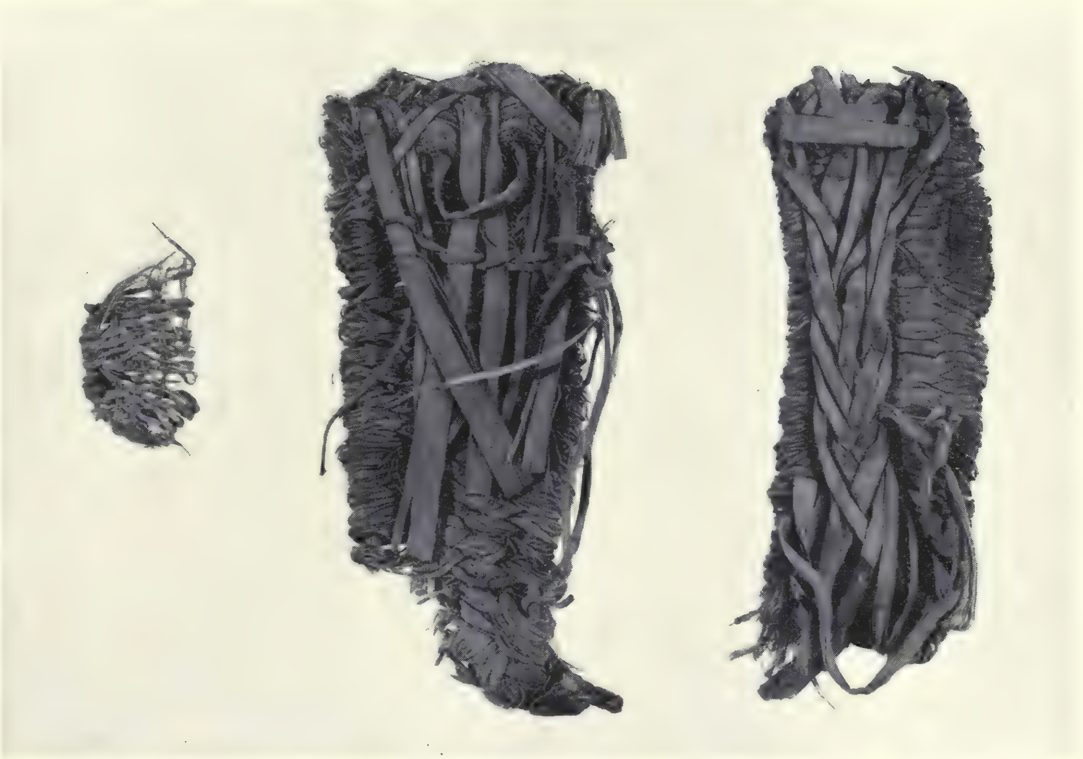


FIG. 89. Four- and five-warp wickerwork sandals: left, five-warp fragment; center and right, four-warp sandals. Length of center sandal, 23.7 cm.

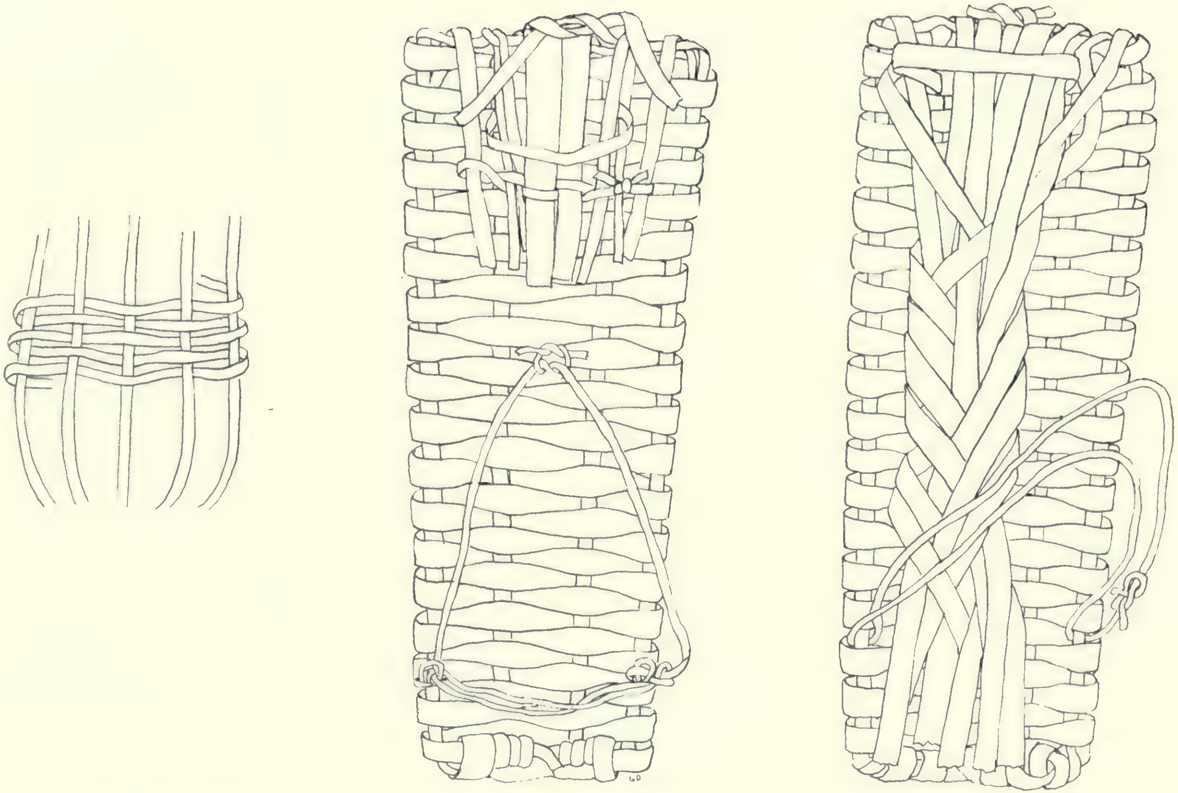


FIG. 90. Drawings showing construction of four- and five-warp wickerwork sandals shown in Figure 89.

Dimensions.—Length, 10.8–27.5 cm. (average 19.9 cm.); width, 5.8–11.7 cm. (average 8.7 cm.).

D. Five-warp wickerwork sandal, plain (Figs. 89, 90, left).

Material.—Warp and weft elements are made of narrow strips of yucca leaves (*Yucca baccata* Torr.).

Manufacture.—The five warp elements are placed parallel to one another, and wefts are woven back and forth across them in a plain over-one-under-one pattern.

As there is only one fragment of this type there is no information on the ties or the method of finishing heel and toe.

Occurrence by Phase, Cordova Cave.—Plain Ware, 1 (fragment).

Dimensions.—Length, incomplete; width, 4.6 cm.

E. Wickerwork fragments.

These small pieces of wickerwork sandals are too fragmentary to be assigned to any one of the above categories.

Occurrence by Phases, Tularosa Cave.—Pre-Pottery, 1; Georgetown, 4; San Francisco, 1.

PLAITED SANDALS

A. Plaited sandals with square toes, made of wide elements (Figs. 91, 92).

Material.—Elements are whole yucca leaves (*Yucca baccata* Torr.), which usually have not been treated or prepared before plaiting. Occasionally they may have been beaten or crushed. Leaves vary in width from about 0.7 to 2.0 cm. Generally they are used singly, but occasionally two leaves are put together for greater strength.

Manufacture.—The sandal is begun by bending 4, or occasionally 3, leaves at the toe to form 8 or 6 elements, respectively. Elements are plaited in an over-two-under-one or, less frequently, over-one-under-one pattern beyond the desired length of the sandal. The surplus is folded over on top of the heel, providing a cushion. Occasionally the ends of the elements are bound by a strip of yucca leaf to prevent fraying. The sandals have square, symmetrical toes and heels; lefts cannot be distinguished from rights.

One unusual sandal from a San Francisco-through-Tularosa level of Tularosa Cave has a "double" sole. The lower sole was made in the usual manner, with an over-two-under-one pattern, and apparently was not long enough, as the ends of the elements at the heel were never folded up. Then another plaited sole was made, in an over-one-under-one pattern, and the ends of the elements were folded over the heel. Then one sole was placed on top of the other and the two were fastened together by additional yucca leaves that were sewed up and down through the elements of both soles along the sides of the sandal (Figs. 91, 92, right).

Two other specimens, one from the San Francisco-through-Tularosa level of Tularosa Cave and the other from the Plain Ware level of Cordova Cave, were each re-enforced by two additional elements that were woven up and down through the wefts of the completed sandals parallel to the warps.

Ties.—The toe tie consists of a narrow leaf or a split section of a leaf, which is inserted under one or two upper elements about 2.5 cm. back from the toe and brought up and tied on top of the second and third toes.

The heel tie is made of a leaf, which goes across the sole of the sandal and under an element on either side, usually from 2.5 to 5.0 cm. from the back; it is then brought up, over the instep, and tied to the toe tie. A thin strip of yucca binds the heel ties together across the back of the foot.

One sandal of this type has fragmentary side-loop ties, rather than the usual toe and heel ties. Four loops are formed along each side of the sandal by a strip of yucca leaf fastened to the upper elements along the edge of the sole (Figs. 91, 92, center).

Occurrence by Phases, Tularosa Cave.—San Francisco, 3 (2 fragmentary); San Francisco-through-Tularosa, 25 (8 fragmentary); Reserve-through-Tularosa, 3 (2 fragmentary).

Occurrence by Phase, Cordova Cave.—Plain Ware, 2.

Dimensions.—Length, 15.3–26.5 cm. (average 22.3 cm.); width, 5.5–12.4 cm. (average 9.4 cm.).

B. Plaited sandals with round toes, made of wide fiber (Figs. 93, 94).

Material.—Elements are whole yucca leaves (*Yucca baccata* Torr.), which usually have not been treated or prepared before plaiting. Occasionally they may have been beaten or crushed first. Leaves vary in width from about 0.7 to 2.0 cm. They are used singly or, in some cases, in pairs.

Manufacture.—Four, or less frequently 3 or 5, leaves are bent at the toe to form 8, 6, or 10 elements, respectively. The elements

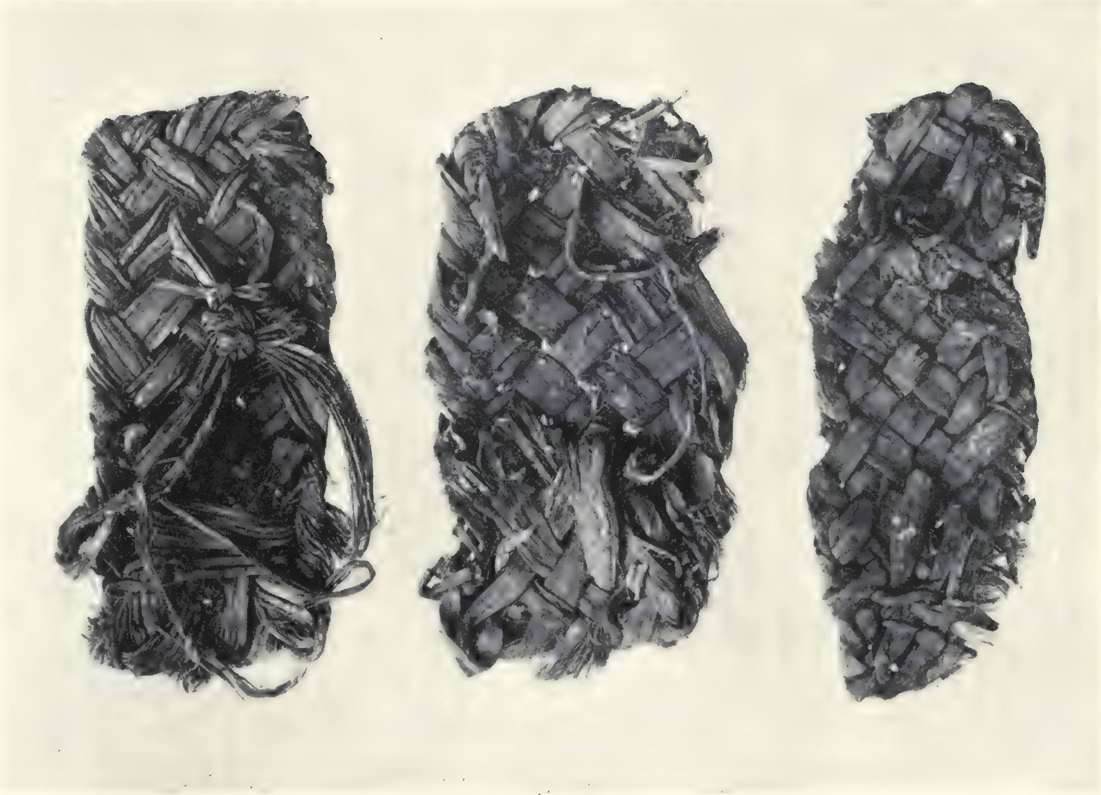


FIG. 91. Square-toed plaited sandals made of wide elements: center, winter type with side-loop ties; right, double sandal; left, typical sandal with heel and toe tie. Length of left sandal, 22.7 cm.

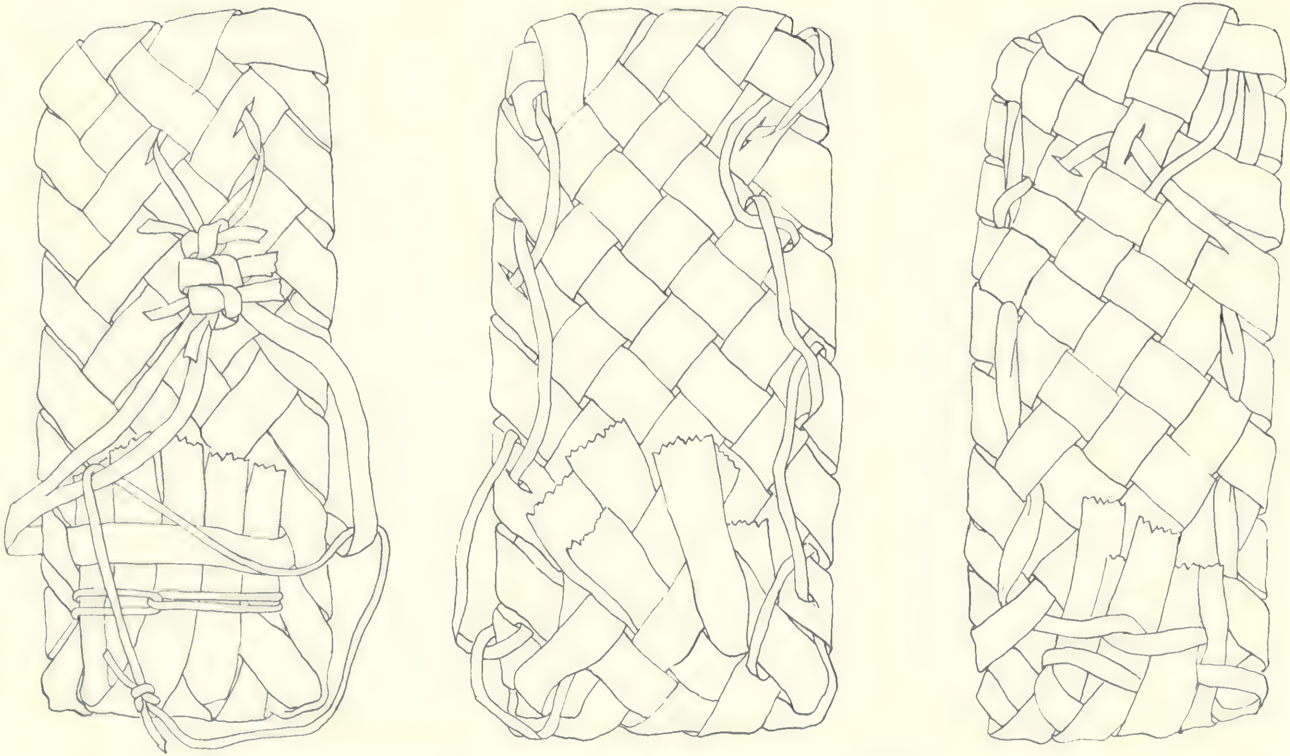


FIG. 92. Drawings showing construction of square-toed plaited sandals shown in Figure 91.

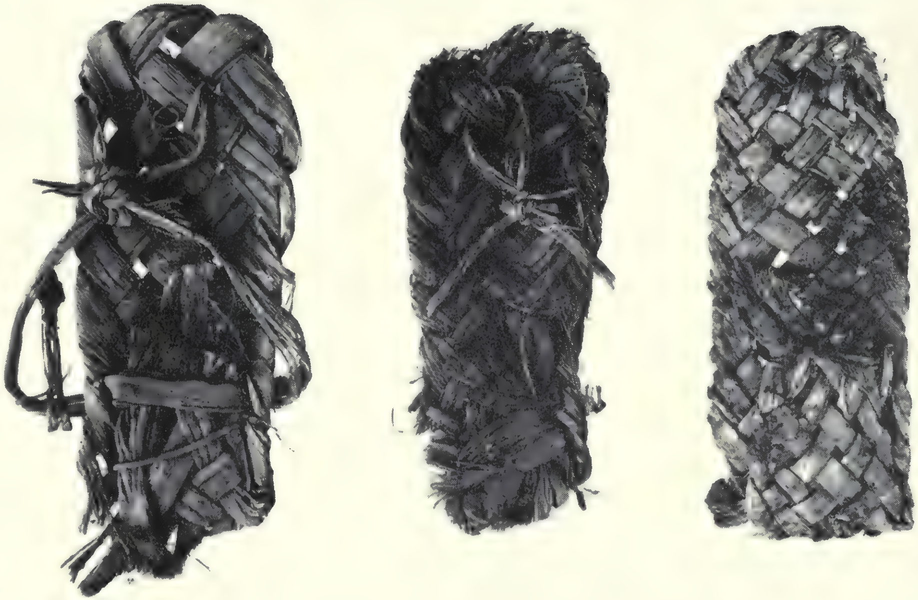


FIG. 93. Round-toed plaited sandals made of wide elements. Length of right sandal, 21.2 cm.

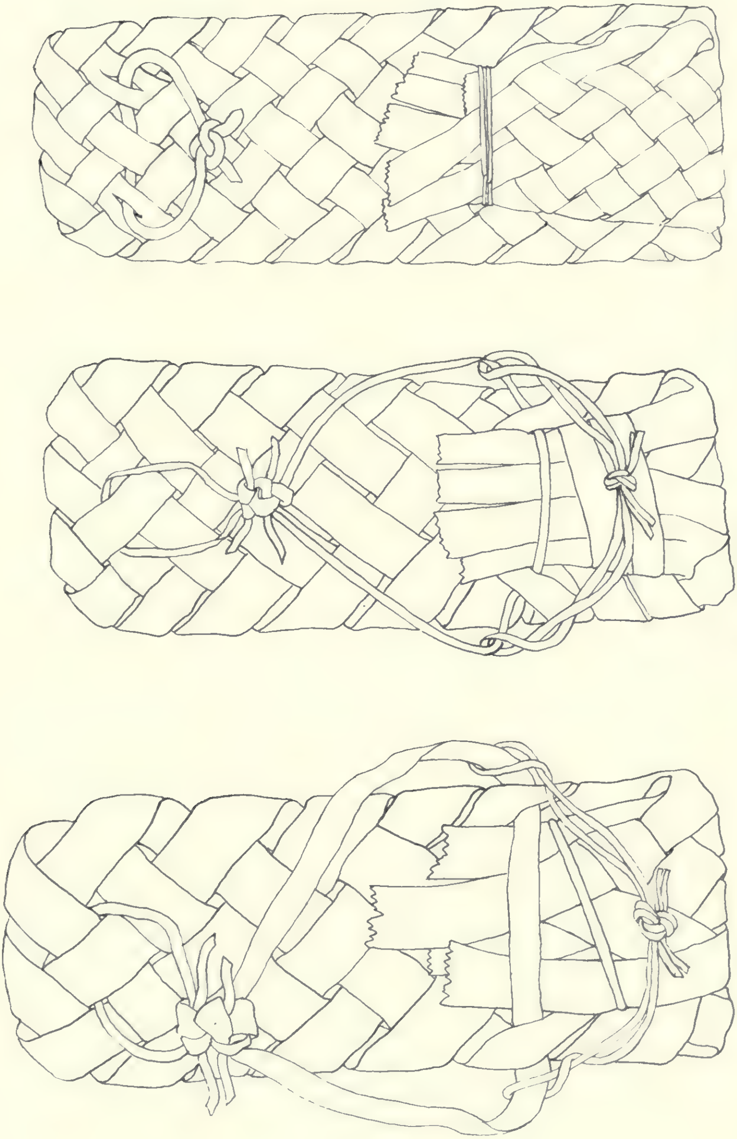


Fig. 94. Drawings showing construction of round-toed plaited sandals shown in Figure 93.

are plaited in an over-two-under-one or over-one-under-one pattern beyond the desired length of the sandal. The surplus is then folded over on top of the heel, providing a cushion. Occasionally the ends of the elements are bound by a strip of split yucca leaf, to prevent fraying. The sandals have a somewhat rounded toe; sometimes the outer corner tends to be rounded more than the inner, so that in many cases lefts can be distinguished from rights. The heel is square.

Ties.—The toe tie consists of a narrow leaf or a split section of a leaf, which is inserted under one or two upper elements about 2.5 cm. back from the toe and brought up and tied on top of the second and third toes.

The heel tie is made of a leaf that goes across the sole of the sandal and under an element on either side, usually from 2.5 to 5.0 cm. from the back; it is then brought up over the instep and tied to the toe tie. A thin strip of yucca leaf links the heel ties together across the back of the foot.

Occurrence by Phases, Tularosa Cave.—Georgetown, 1 (complete); San Francisco, 1 (fragment); San Francisco-through-Tularosa, 11 (4 fragmentary); Reserve-through-Tularosa, 3 (complete).

Dimensions.—Length, 15.5–23.5 cm. (average 21.0 cm.); width, 5.6–11.1 cm. (average 9.1 cm.).

C. Plaited sandal fragments, made of wide elements.

These small pieces of plaited sandals, made of wide elements, are too fragmentary to be assigned to either of the above categories.

Occurrence by Phases, Tularosa Cave.—San Francisco, 6; San Francisco-through-Tularosa, 28; Reserve-through-Tularosa, 2.

Occurrence by Phase, Cordova Cave.—Late, 1.

D. Plaited sandals with square toes, made of narrow elements (Figs. 95, 96, left, center).

Material.—Elements are narrow strips of yucca leaves (*Yucca baccata* Torr.), the individual strips varying in width from 0.2 to 0.6 cm.

Manufacture.—The strips of leaves are bent at the toe to produce twice as many elements as there are leaves. Five sandals or fragments of sandals of this type were found; one had 8 elements, two had 10, one had 16, and one fragment had at least 22. The elements are plaited in an over-two-under-one or over-one-under-one pattern. There are only two complete sandals of this type. The elements of one were plaited beyond the desired length of the sandal and then the surplus was folded over the heel to form a cushion. The ends of the elements of the other sandal had not been folded over the heel. In both, the ends of the elements were bound with narrow strips of leaves, to prevent fraying. The sandals have square toes, and one has a square heel.

All of these sandals appear to have been made for children or infants. The average width and length of the complete specimens were considerably below the average dimensions of plaited sandals of wide elements. The one finished sandal, with the ends of the elements folded back, was 11.2 cm. long; the other was 8.7 cm. long.

Ties.—No ties were present on any of these specimens.

Occurrence by Phases, Tularosa Cave.—San Francisco-through-Tularosa, 4 (3 fragmentary); Reserve-through-Tularosa, 1 (complete).

Dimensions.—Length, 11.2 cm., 8.7 cm.; width, 5.4 cm., 3.2 cm.

E. Plaited sandals with rounded toes, made of narrow elements (Figs. 95, 96, right).

Material.—Elements are narrow strips of yucca leaves (*Yucca baccata* Torr.); the individual strips vary in width from 0.2 to 0.6 cm.

Manufacture.—Only two fragmentary sandals of this type were found, both in Tularosa Cave. One, from the San Francisco Phase, was made by folding five strips of yucca leaves at the toe to produce ten elements, which were plaited in an over-one-under-one pattern. This was a child's sandal, 2.6 cm. wide, and not complete; the length could not be determined.

The other sandal, from a San Francisco-through-Tularosa level, was made by bending 14 strips of leaves at the toe to produce 28 elements. The greater part of the sandal is plaited in an over-two-under-two pattern, but down the center is an area plaited in an over-two-under-three pattern. This is a large sandal, 10.1 cm. wide, though the length is incomplete. It is by far the best-made of all the plaited sandals.

Occurrence by Phases, Tularosa Cave.—San Francisco, 1 (fragment); San Francisco-through-Tularosa, 1 (fragment).

Dimensions.—Length, incomplete; width, 2.6 cm., 10.1 cm.

F. Plaited sandal fragments, made of narrow elements.

A small piece of a plaited sandal, made of narrow elements, too fragmentary to be assigned to either of the above categories.

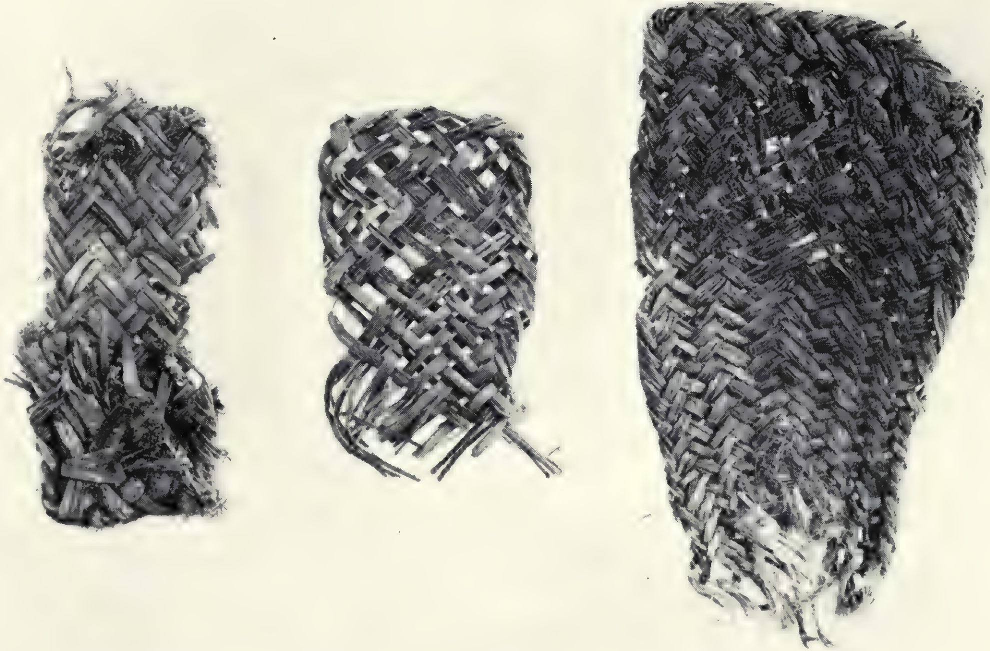


FIG. 95. Plaited sandals made of narrow elements: left and center, square-toed; right, round-toed. Length of left sandal, 11.2 cm.

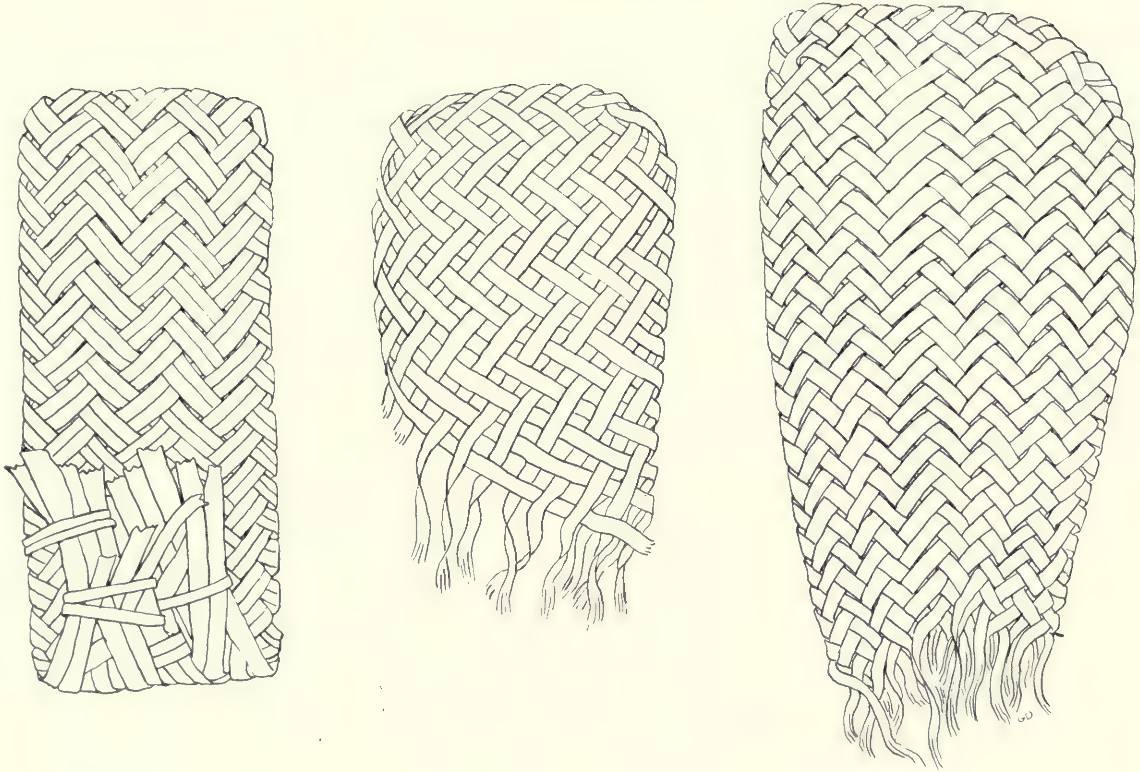


FIG. 96. Drawings showing construction of plaited sandals shown in Figure 95.

Occurrence by Phase, Tularosa Cave.—San Francisco-through-Tularosa, 1 (fragment).

MULTIPLE-WARP CORD SANDALS

A. Multiple-warp cord sandals, scalloped toe (Figs. 97, 98).

Material.—Warp elements are made of two-yarn cord, wefts of single-ply yarn or two-yarn cord, which is finer than the warp. Both warp and weft cords are made of hard fibers; in one sandal from the San Francisco Phase of Tularosa Cave the weft is made of bast fiber.

Manufacture.—Four sandals of this type have 16 warps, two have 14, and one has 12. In each case the method of construction is the same. The warp cord begins at the heel, extends down to the toe, and back to the heel, so that two warp elements are made of one piece of cord. In the 16-warp sandals the following warps are so paired: 1 and 3, 2 and 5, 4 and 7, 6 and 9, 8 and 11, 10 and 13, 12 and 15, 14 and 16. The pattern in the 14-warp sandal is the same, except that 12 and 14 are the last pair of warps, and in the 12-warp sandal 10 and 12 are the last.

In the center of the sandal the weft strands are woven in a plain over-one-under-one weave. The heel and toe of each sandal are reinforced by varying the weaving pattern with over-one-under-three, thereby skipping the warp on the under side and producing a thicker sole. Where the weft strands pass over the outer warp on either side of the sandal, part of each strand is cut or worn so that the upper surface of the sandal is fringed along the edge. One sandal has a twined woven section across the toe and heel.

When the sandal has been completed, the outer warp strands are pulled together and tied to produce a puckered heel. The remainder of the strands are gathered together and divided into two groups, which are usually twisted to form a heavy cord that ties about the ankle. In one case only part of these warp strands are twisted together and extended around the ankle; the remainder are bound together and cut off close to the heel.

These sandals are symmetrical, with scalloped toes; lefts cannot be distinguished from rights. They are well made and firmly woven, averaging 16 wefts per centimeter.

Ties.—The ankle tie described above is made of the ends of the warp elements, twisted together and extended around the ankle.

The heel tie is fastened to the next to the outside warp on either side of the heel, or to a small loop fastened to that warp. The tie starts in front of the ankle, goes under the next to the outside warp on one side, back to the front of the ankle, down to the toe tie and through it, loops about itself coming back, goes under the next to the outside warp on the other side of the heel, and back to the front of the ankle, where it is tied.

The toe tie consists of at least one but usually several pieces of string that are fastened under one or two warps on either side about 2 to 3 cm. back from the toe, spanning a distance of 6 warps in the center of the sandal. One tie is red; the others are natural fiber color.

One sandal of this type has side loops in place of the other ties. The edges of the sandal were first reinforced with a binding of 3-ply braid, which held the outer two warps on either side together. Then a heavy 4-ply cord was fastened under the outer warp at approximately equally spaced intervals along each side to produce eight loops per side. Another cord ties across the toes.

Occurrence by Phases, Tularosa Cave.—Georgetown, 3 (complete); San Francisco, 3 (complete); San Francisco-through-Tularosa, 1 (complete).

Dimensions.—Length, 22.2–25.0 cm. (average 23.4 cm.); width, 9.3–14.5 cm. (average 11.0 cm.).

B. Multiple-warp cord sandals, square toe (Figs. 99, 100, left).

Material.—Warp and weft strands are made of two-yarn cords, but the wefts are smaller in diameter and finer in quality than the warps. Warps are made of hard fiber, wefts of bast fiber.

Manufacture.—Each pair of adjacent warp elements is made of one continuous strand of cord. In eight cases, the cord begins at the heel, extends down to the toe, and back to the heel, producing 16 full-length warps. In four cases, the cord begins at the heel, extends down to the toe, and back for a distance of 6.5 cm. (about one-fourth the length of the sandal), producing 4 full-length and 4 toe-length warps. The result is 24 warps across the toe of the sandal and 20 across the heel.

Weaving is plain over-one-under-one in the center of the sandal. The toe and heel are reinforced by skipping warps on the under side, producing an under-two-over-one pattern.

The outer warp strands were pulled together and tied to produce a puckered heel. The remaining warp strands were wound once around the last of the weft strands at the heel, and then twisted together to form a rope, which was probably tied around the ankle.

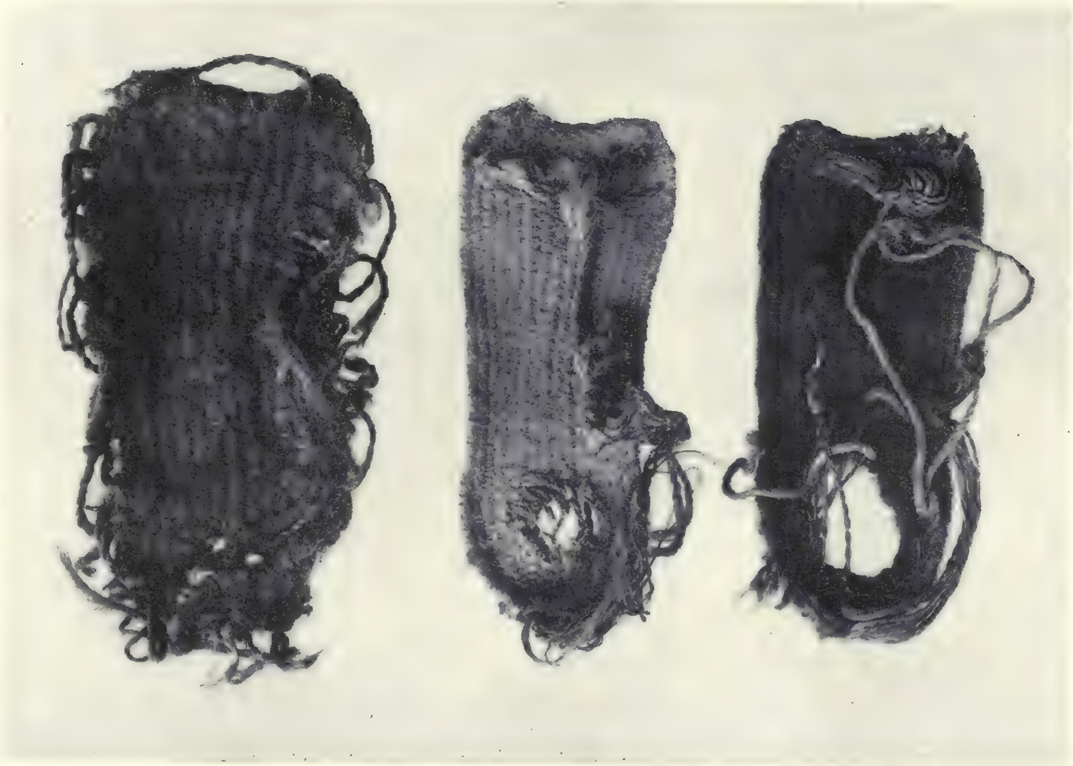


FIG. 97. Multiple-warp cord sandals with scalloped toes: left, winter type with side-loop ties; center, twined toe and heel; right, typical sandal with ties complete. Length of center sandal, 23.7 cm.

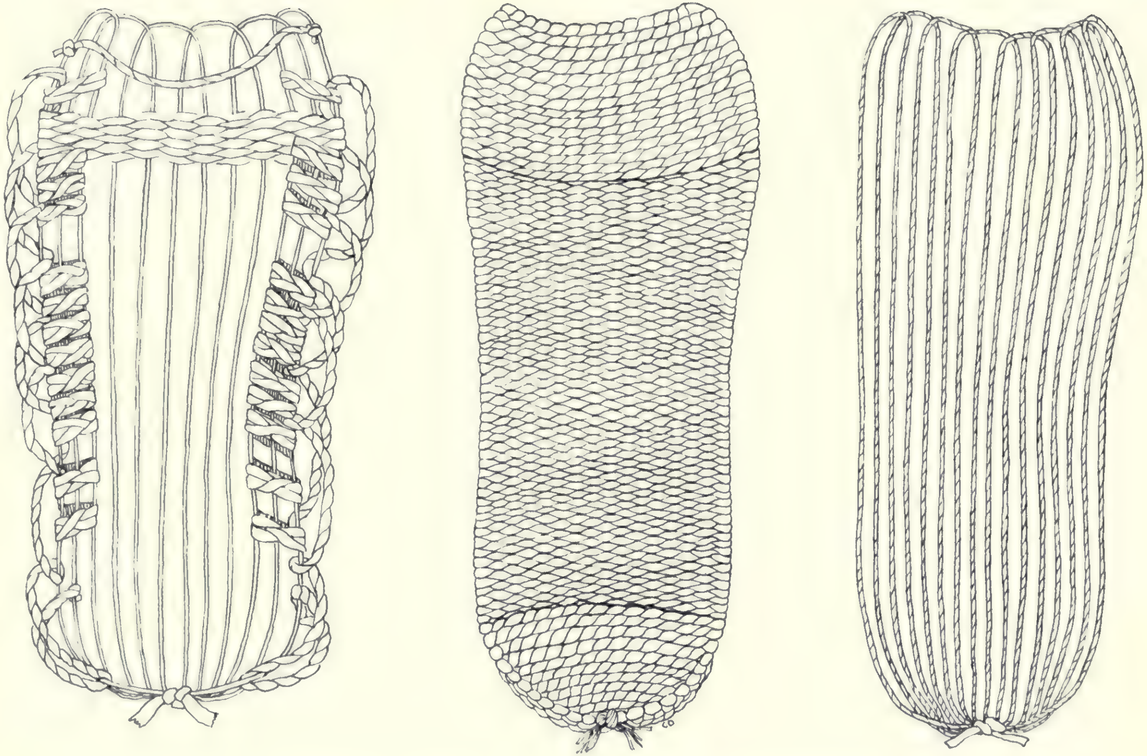


FIG. 98. Drawings showing construction of multiple-warp cord sandals shown in Figure 97.

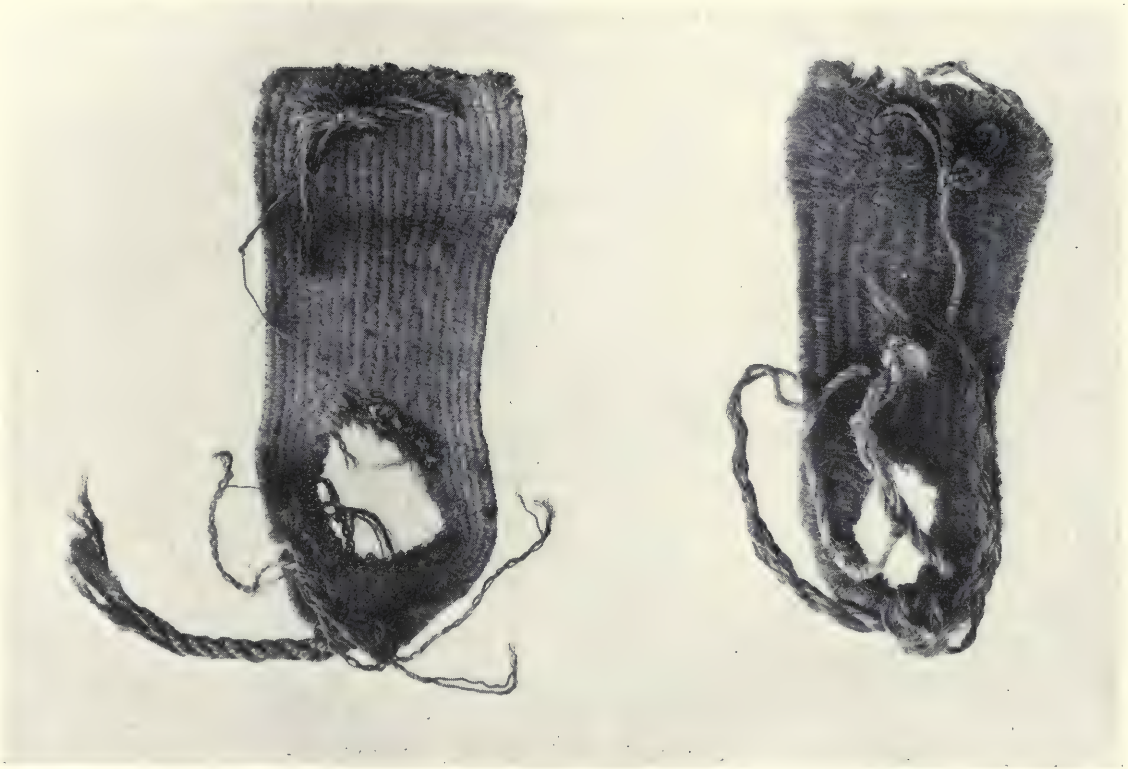


FIG. 99. Multiple-warp cord sandals: left, square-toed type; right, round-toed type. Length of left sandal, 25.5 cm.

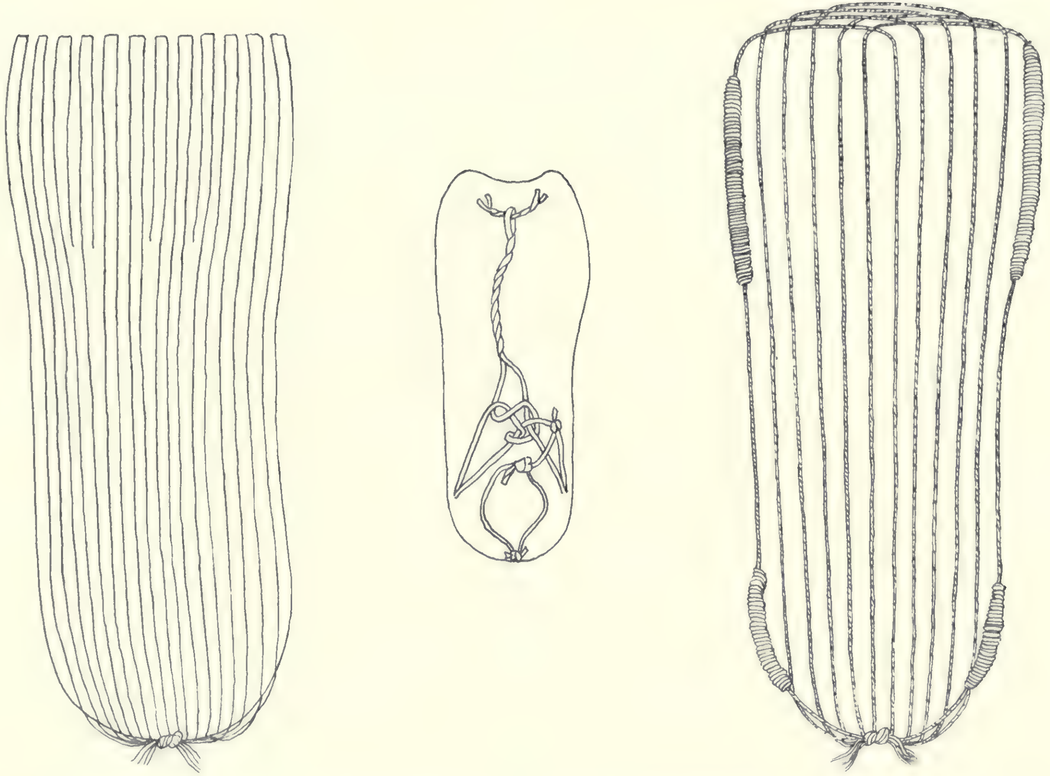


FIG. 100. Drawings showing construction of multiple-warp cord sandals shown in Figure 99. Center drawing shows ties typical of all multiple-warp sandals.

The sandal is tightly woven (about 16 wefts per centimeter), with a square toe. It is wider across the toe than in the center and at the heel and is symmetrical, with no suggestion as to whether it was worn on the left or right foot.

Ties.—The ankle tie is made of the ends of the warp elements, which are twisted together and extended around the ankle. Other heel ties are missing from this sandal.

The toe tie consists of a bunch of fine string inserted through the sole under the seventh and fourteenth warps about 1 cm. back from the toe and bound together on top of the toe.

Occurrence by Phase, Tularosa Cave.—Georgetown, 1 (complete).

Dimensions.—Length, 25.5 cm.; width, 11.5 cm.

C. Multiple-warp cord sandals, round toe (Figs. 99, 100, right).

Material.—Warp strands are made of two-yarn cord, weft elements of single-ply yarn. Both warp and weft are made of hard fiber.

Manufacture.—There are 12 warps in this sandal. Each warp cord begins at the heel, extends down to the toe, and back to the heel, so that two warp elements are made of one piece of cord. The following warps appear to be so paired: 1 and 7, 2 and 11, 3 and 10, 4 and 8, 5 and 9, 6 and 12. Outer warps on either side of the toe are wrapped with fiber to increase the width of the sandal.

In the center of the sandal the weft strands are woven in a plain over-one-under-one weave. The heel and toe areas are reinforced by varying the weaving pattern with over-one-under-three, thereby skipping warps on the under side and producing a thicker sole. Where the weft strands pass over the outer warps on either side of the sandal, part of each strand is cut or worn, leaving a fringe along the edge of the upper surface of the sandal.

The outer warp strands were pulled together and tied to produce a puckered heel. The other warps were wound around this knot, twisted to form a heavy cord, and tied around the ankle.

Although the toe is worn, it seems to have been rounded when new. The sandal is wider at the toe than in the center or at the heel. The slight asymmetry in the shape suggests that it was worn on the right foot. It is well made and firmly woven, averaging 16 wefts per centimeter.

Ties.—The ankle tie is made of the ends of the warp elements, which are twisted together and extended around the ankle.

The heel tie starts in front of the ankle, goes under the next to the outside warp on one side, back to the front of the ankle, down to the toe tie and through it, loops about itself coming back, goes under the next to the outside warp on the other side of the heel, and back to the front of the ankle, where it is tied.

The toe tie consists of two pieces of red string, which are fastened under the fourth and tenth warps, about 2 cm. back from the toe, and tied on top.

Occurrence by Phase, Tularosa Cave.—Georgetown, 1 (complete).

Dimensions.—Length, 23.5 cm.; width, 11.5 cm.

D. Multiple-warp cord sandals (fragments).

These pieces of multiple-warp cord sandals are too small to be assigned to one of the above categories. One fragment, from the Georgetown Phase, is part of an 8-warp sandal, woven in a plain over-one-under-one pattern.

The other fragment, from the San Francisco Phase, is woven in a twined weave.

Occurrence by Phases, Tularosa Cave.—Georgetown, 1 (fragment); San Francisco, 1 (fragment).

CONTINUOUS-OUTER-WARP CORD SANDALS

A. Continuous-outer-warp cord sandals, eight-warp (Figs. 101, 102, left).

Material.—Warp elements are made of two-yarn cord, weft strands of loosely twisted single-ply yarn. Both the warps and wefts are made of hard fiber.

Manufacture.—The outer warp is a loop of two-yarn cord, knotted at the heel. The other warp strands are fastened to this loop. Each strand consists of a single-ply yarn strand, which is folded over the outer warp at the toe and twisted around itself to produce a two-yarn cord. There are six of these, making eight warps in all. The outer warps are wound with fiber at the toe to increase the width of the sandal.

Weft elements are woven in an over-one-under-one pattern back and forth across the sandal. Part of the yarn is frayed out as it goes over the outer warp, producing a somewhat fringed edge on the upper side of the sandal.

The warp elements are gathered together and tied at the heel to produce a puckered heel.

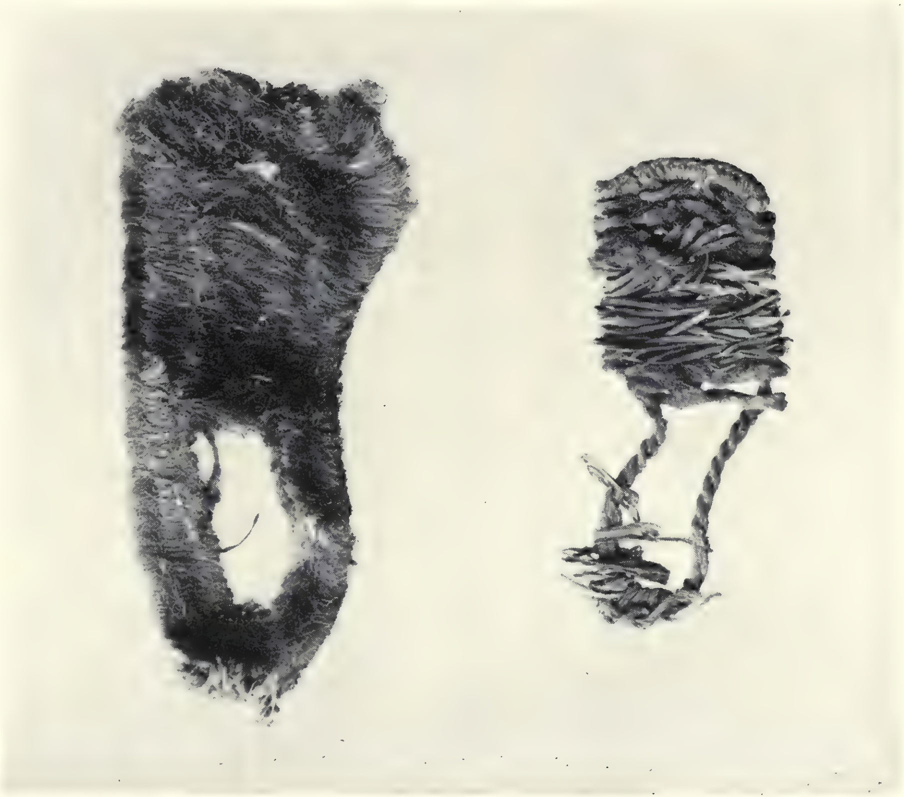


FIG. 101. Continuous-outer-warp cord sandals: left, eight-warp type; right, four-warp type. Length of left sandal, 24.4 cm.

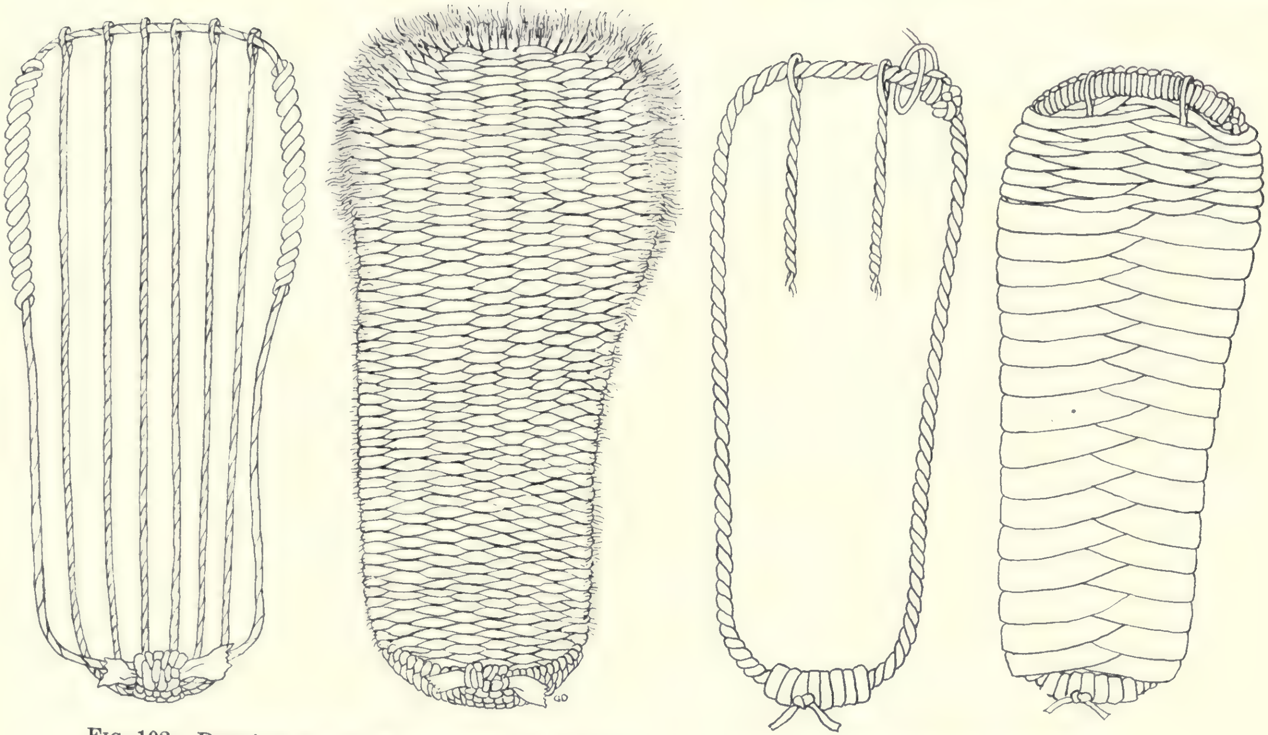


FIG. 102. Drawings showing construction of continuous-outer-warp cord sandals shown in Figure 101.

Ties.—No ties are present.

Occurrence by Phase, Tularosa Cave.—San Francisco, 1.

Dimensions.—Length, 24.4 cm.; width, 12.0 cm.

B. Continuous-outer-warp cord sandals, four-warp (Figs. 101, 102, right).

Material.—The warp strands are made of heavy two-yarn cord. Original weft strands were probably all loosely twisted single-ply yarns. Both warp and weft are hard fiber.

Manufacture.—The outer warp is one continuous strand, knotted at the heel. Each inner warp consists of a single-ply yarn, which is folded over the outer warp at the toe and twisted around itself to produce a two-yarn cord. There are two of these elements, making four warps in all. Only fragments of the two inner warps remain. After the inner warps were in place, the part of the outer loop which crosses the toe was bound for a distance of about 8 cm. with a crochet type of stitch.

The weft strands were woven in a plain over-one-under-one pattern.

When the inner warp and weft strands in the central part of the sandal were worn out, the sandal was repaired. Wefts were replaced by strips of yucca leaves, woven back and forth across the outer warps that remained. At the heel, strips of leaves are wound around the knotted warp strands.

Ties.—No ties remain.

Occurrence by Phase, Tularosa Cave.—Pine Lawn, 1.

Dimensions.—Length, 22.0 cm.; width, 6.8 cm.

CONCENTRIC-WARP CORD SANDALS

A. Concentric-warp cord sandals, four-warp (Figs. 103, 104).

Material.—Warp elements are made of two-yarn cord, wefts of single-ply yarn. Both are made of hard fiber.

Manufacture.—The four warp elements consist of two loops of cord, one placed inside the other, with the knots at the heel. At the heel and toe, where the loops are tangent, they are bound together with single-ply yarn. In one sandal the loops are not bound at the heel.

The weft strands are woven back and forth in an over-one-under-one pattern across the warps. As a strand passes over the outer warp, part of the yarn is cut or worn, producing a somewhat fringed edge all around the sandal on the upper side.

These sandals are soft, flexible, and symmetrical; lefts cannot be distinguished from rights.

Ties.—The toe tie consists of one or more pieces of string fastened under each of the two central warps from 2 to 4 cm. back from the toe, producing a loop in the center of the sandal.

The heel tie consists of a piece of string that goes under the outer warp, loops around itself, passes in front of the ankle and down to the toe tie and back. It is twisted as it comes back, producing a single cord. It goes under the outer warp on the other side of the heel, loops around itself, passes in front of the ankle again, looping across the part coming from the other side of the heel, and finally is tied. Another string links the two parts of the tie back of the heel.

Occurrence by Phases, Tularosa Cave.—Pre-Pottery, 2 (fragments); Pine Lawn, 1 (complete); San Francisco, 4 (fragments); San Francisco-through-Tularosa, 1 (complete).

Occurrence by Phase, Cordova Cave.—Plain Ware, 1 (fragment).

Dimensions.—Length, 18.4–23.5 cm. (average 21.0 cm.); width, 6.2–6.8 cm. (average 6.5 cm.).

B. Concentric-warp cord sandals, six-warp (Figs. 105, 106).

Material.—Warp elements are made of two-yarn cord, wefts of single-ply yarn. Both are hard fiber.

Manufacture.—Two sandals of this type were found. One has six warps, made of three loops of cord, placed one inside the other with the knots at the heel. The other is similar, but near the toe the two inside warps on either side are twisted together so that the sandal has six warps for the greater part of its length, but four warps across the toe. In both sandals, the loops are bound together at the toe, where the loops are tangent.

Weft strands are woven back and forth in an over-one-under-one pattern across the warps. Where weft strands pass over the outer warp on either side they are cut or worn so that there is a somewhat fringed edge along the sandal on the upper side.

The sandals are soft, flexible, and symmetrical; lefts cannot be distinguished from rights.

Ties.—The toe tie consists of several pieces of fine string fastened under the two inner warps in the one case, and under the second

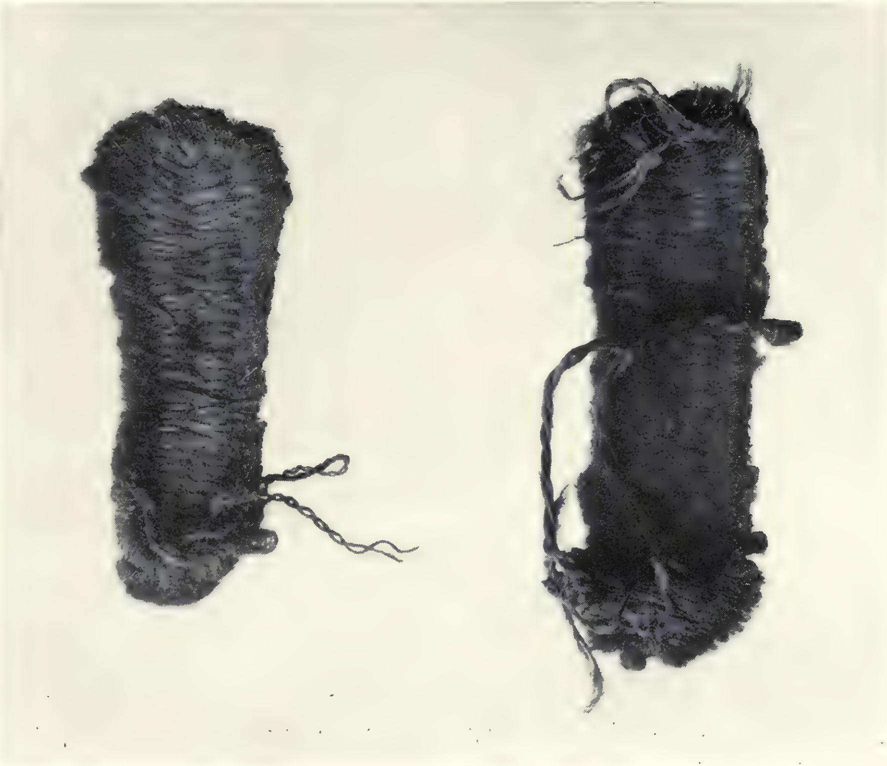


FIG. 103. Four-warp, concentric-warp cord sandals. Length of left sandal, 18.4 cm.

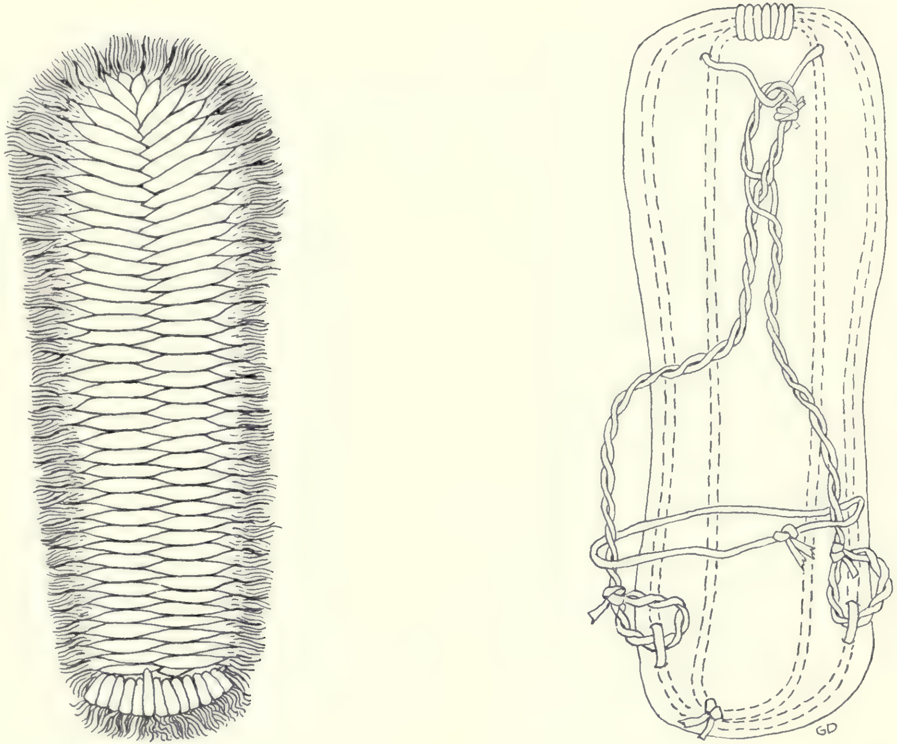


FIG. 104. Drawings showing construction of four-warp, concentric-warp cord sandals shown in Figure 103. Drawing on left shows weave; drawing on right shows warps and ties.

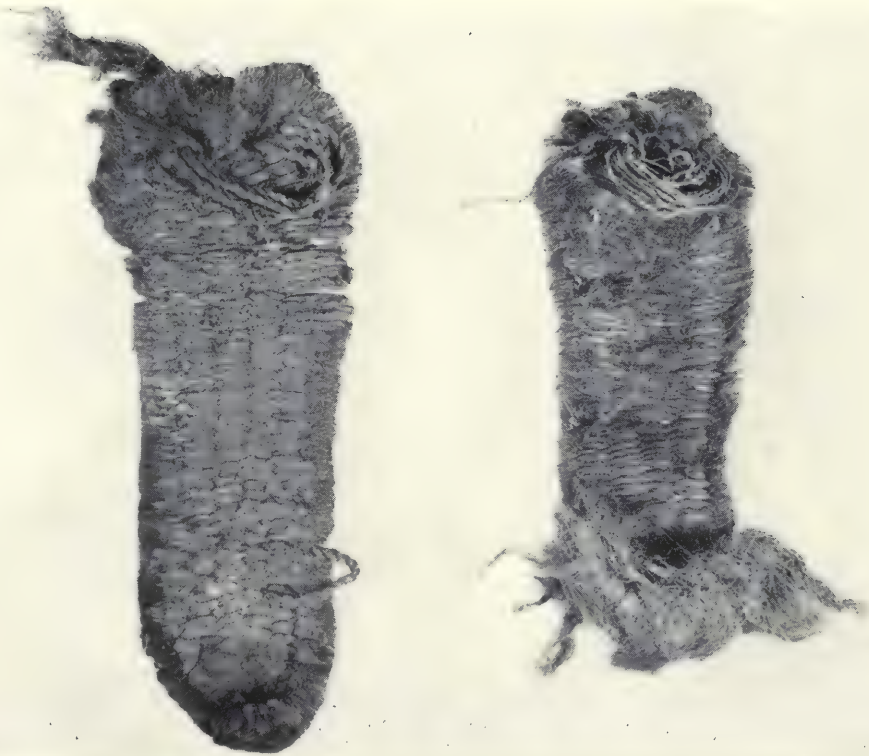


FIG. 105. Six-warp, concentric-warp cord sandals: right, variation in which two inner warps combine at toe.

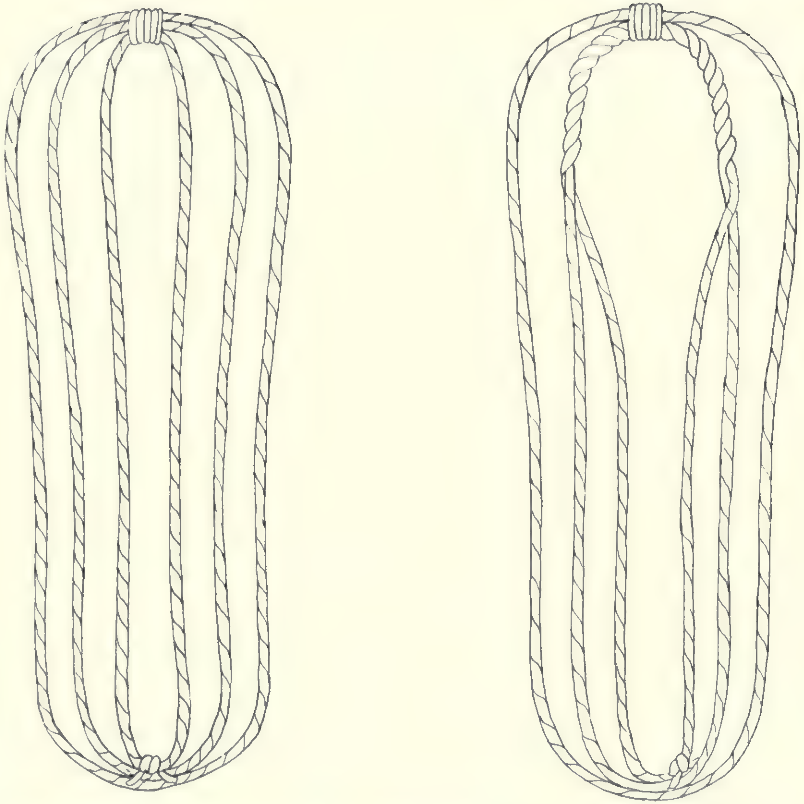


FIG. 106. Drawings showing construction of six-warp, concentric-warp cord sandals shown in Figure 105.

and fourth warps in the other, about 3 cm. back from the toe, producing a loop in the center of the sandal.

Heel ties are missing.

Occurrence by Phase, Cordova Cave.—Plain Ware, 2 (complete).

Dimensions.—Length, 23.0, 27.0 cm.; width, 9.0, 10.0 cm.

C. Concentric-warp cord sandals (fragments).

These small pieces of concentric, warp cord sandals are too fragmentary to be assigned to one of the above categories.

Occurrence by Phases, Cordova Cave.—Late, 1; Plain Ware, 2; Pre-Pottery, 2.

SCUFFER-TOE SANDALS

A. Scuffer-toe sandals, wickerwork (Figs. 107, 108, right).

Material.—Both warp and weft elements in two sandals of this type were made of yucca leaves (*Yucca baccata* Torr.), which had been mashed before weaving. Warp elements of the third sandal were made of strips of yucca leaves, the weft elements of whole leaves.

Manufacture.—The two warps were knotted at the heel in a square knot and brought down to the toe, where, when the sole had been completed they were knotted again.

The weft was woven back and forth over and under the warps. The sandals are short and wide; the width is greater than the distance between the two warps.

Ties.—The ends of the warp fibers were knotted at the toe and brought up on top of the sandal. The toe loop was formed when they were firmly knotted again, about 3 cm. back from the toe.

No heel ties are present.

Occurrence by Phase, Tularosa Cave.—San Francisco-through-Tularosa, 3 (complete).

Dimensions.—Length, 7.1–9.4 cm. (average 8.1 cm.); width, 6.0–12.2 cm. (average 8.7 cm.).

B. Scuffer-toe cord sandals, continuous-outer-warp (Figs. 107, 108, center).

Material.—Originally both warp and weft elements were made of two-yarn cord; however, the sole was repaired and the weft replaced with crushed yucca leaves (*Yucca baccata* Torr.).

Manufacture.—A two-yarn cord forms the two warp elements. The cord was tied to form a circle about 8 cm. in diameter, with a knot at the heel.

Across this circle, weft strands were woven, over and under the warp. At the toe, the end of the weft strand was wound around the warp, reinforcing it. The wefts in the center of the sole wore out, but the part which was wrapped around the warp remained and it resembles a binding about the original warp cord, strengthening it and adding to its thickness, so that it serves as a framework about 1.2 cm. thick. Over this, crushed yucca leaves were woven in a diagonal over-one-under-one pattern. The sandal is circular.

Ties.—Heel ties are made of two-yarn cord, which goes under the warp on one side, crosses behind the heel, goes under the warp on the other side, and ties behind the heel.

The toe tie is a two-yarn cord that goes under the warp, twists around itself, goes back under the warp, twists about itself, and ties, producing a sturdy loop at the front edge of the reinforced toe.

Occurrence by Phase, Tularosa Cave.—San Francisco, 1 (complete).

Dimensions.—Length, 9.9 cm.; width, 9.3 cm.

C. Scuffer-toe sandal, plaited (Figs. 107, 108, left).

Material.—Elements are yucca leaves (*Yucca baccata* Torr.), which apparently were not treated before plaiting.

Manufacture.—The sandal appears to have been made of at least four yucca leaves folded at the toe and plaited in an over-one-under-one diagonal pattern. Additional elements were woven in from the sides of the sandal to bind the ends of the elements, and they complicate and obscure the pattern. This is a small, compact, worn sandal, roughly triangular in outline.

Ties.—No ties are present.

Occurrence by Phase, Tularosa Cave.—San Francisco-through-Tularosa, 1 (complete).

Dimensions.—Length, 10.0 cm.; wide, 9.5 cm.

Leather Sandals

LEATHER SANDALS, PLAIN (FIG. 109)

Material.—The sole was made of pronghorn antelope hide, taken from the head of the animal.

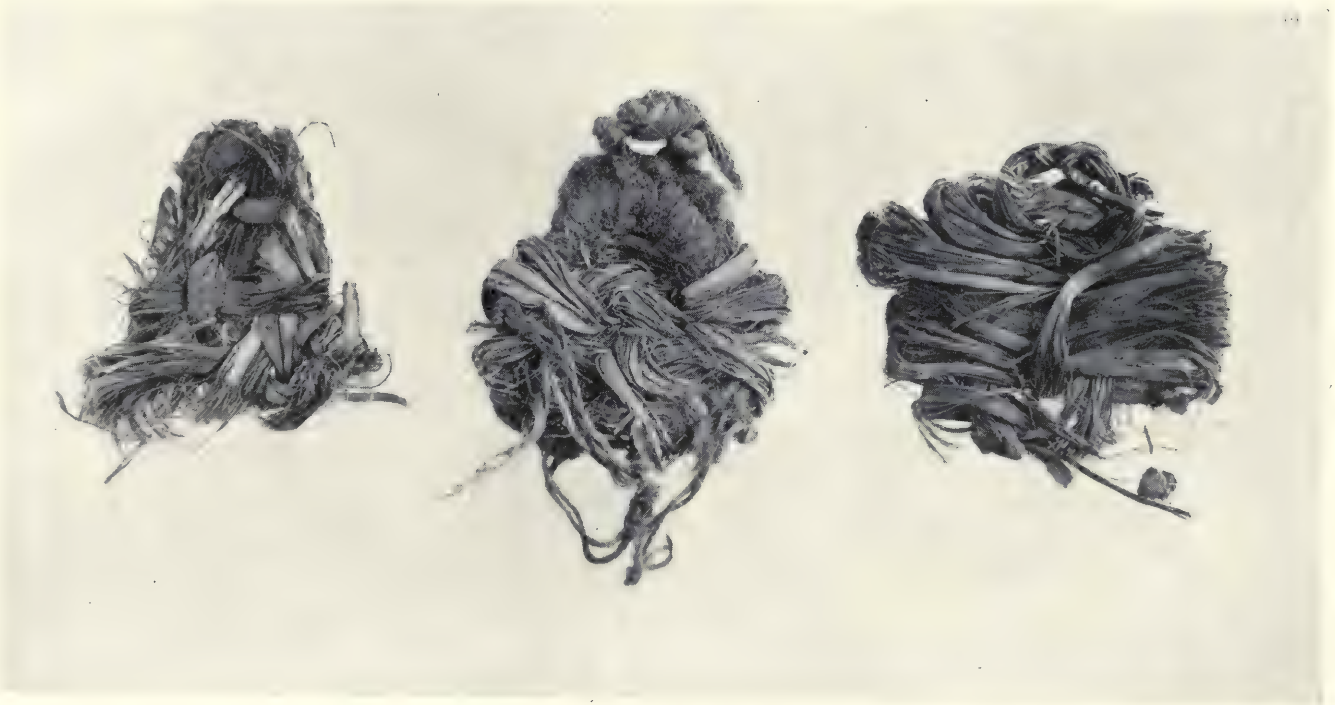


FIG. 107. Scuffer-toe sandals: left, plaited; center, continuous-outer-warp cord; right, two-warp wickerwork. Length of right sandal, 9.4 cm.

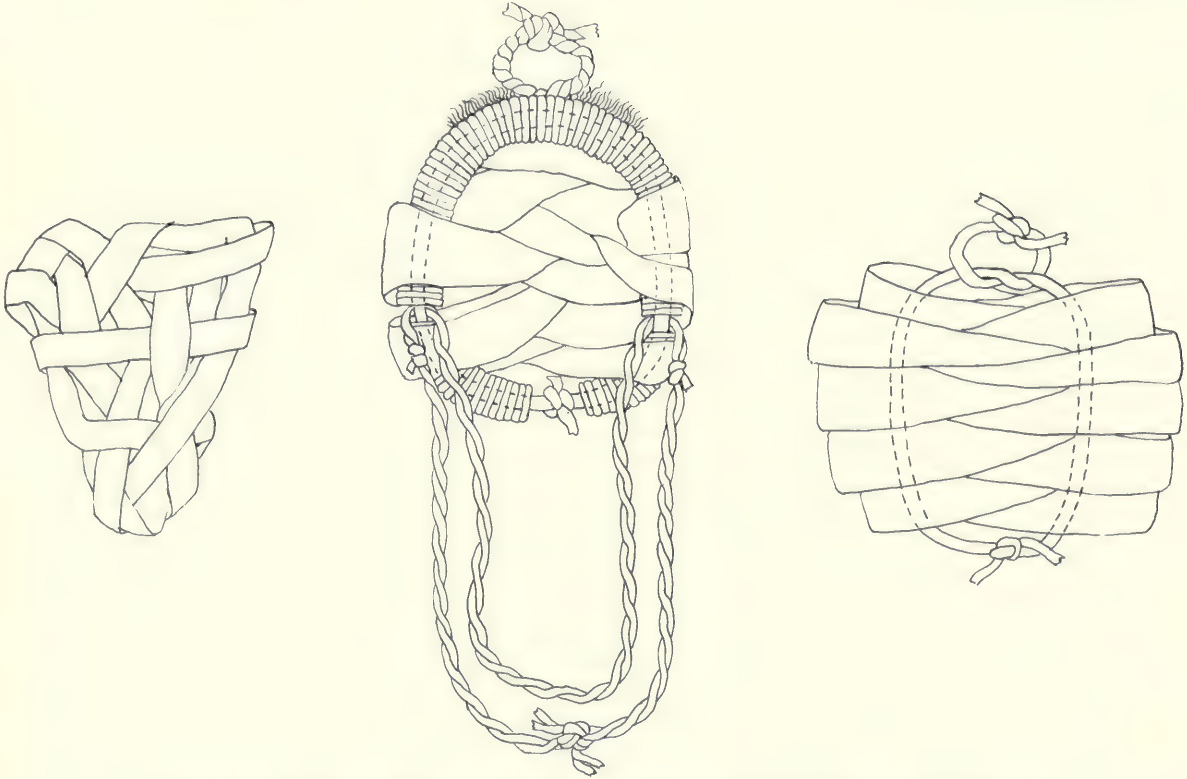


FIG. 108. Drawings showing construction of scuffer-toe sandals shown in Figure 107.

Manufacture.—The sandal consists of one, or in one case of two, pieces of leather cut out in a foot-shaped pattern, wider at the toe than at the heel, with rounded toe and heel.

Ties.—The toe tie consists of a narrow strip of leather inserted through the sole of the sandal and tied.

Heel ties are narrow strips of leather. The tie goes through the sole on one side of the heel and up, looping about itself; crosses behind the heel, through the sole on the other side and up, looping about itself; and ties in front of the ankle. Another strip of leather connects the heel tie with the toe tie.

Occurrence by Phases, Tularosa Cave.—Georgetown, 2 (complete); Georgetown-through-San Francisco, 1 (complete).

Dimensions.—Length, 19.4–25.0 cm. (average 22.8 cm.); width, 11.3–12.3 cm. (average 11.7 cm.).

LEATHER SANDALS, SIDE-LOOP TIES (FIG. 110)

Material.—The sole was made of pronghorn antelope hide, taken from the head of the animal.

Manufacture.—An oval piece of leather, usually with the fur inside, forms the sole. The leather is pulled up so that the sandal comes up along the sides of the foot, providing more protection than a flat sole.

In most cases, these sandals have a thick lining or "sock" of fiber and grass.

Two sandals showed evidence of repair. Holes in the sole of one had been sewed together, and another had been patched by placing a second piece of leather inside the worn sandal.

Ties.—A strip of leather or yucca is attached at intervals along each side of the sandal, forming from eight to ten loops on each side. String or yucca laces back and forth between these loops across the top of the sandal, fastening it to the foot.

Occurrence by Phases, Tularosa Cave.—Pre-Pottery, 6 (3 fragmentary); Pine Lawn, 1 (complete); San Francisco, 1 (complete); San Francisco-through-Tularosa, 1 (fragment).

Dimensions.—Length, 16.4–26.5 cm. (average 22.1 cm.); width, 7.9–14.5 cm. (average 10.9 cm.).

Moccasin(?)

Material.—Both moccasin and sewing elements were made of leather.

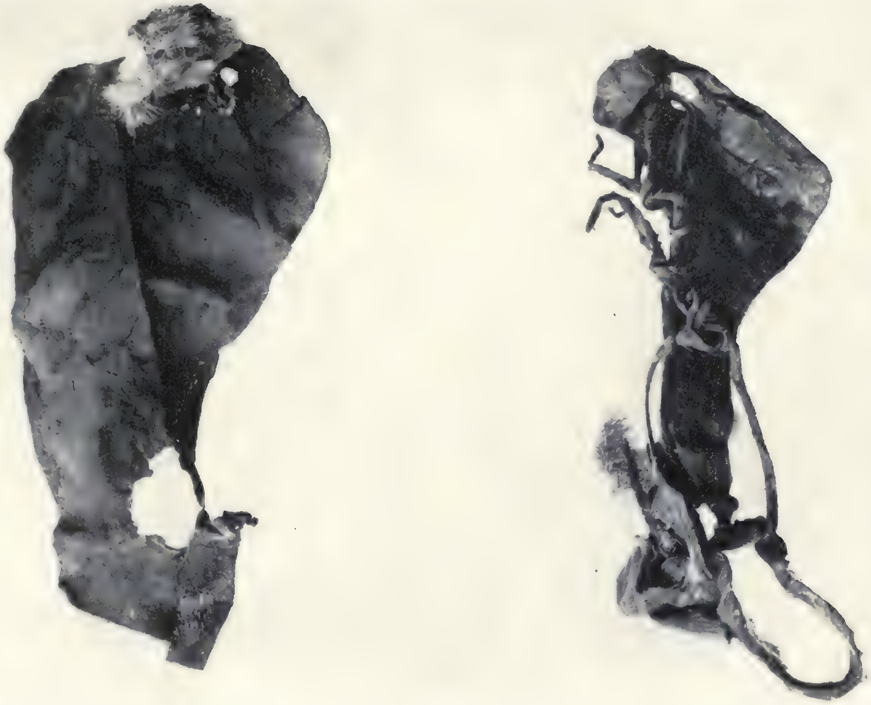


FIG. 109. Plain leather sandals. Length of left sandal, 24.8 cm.

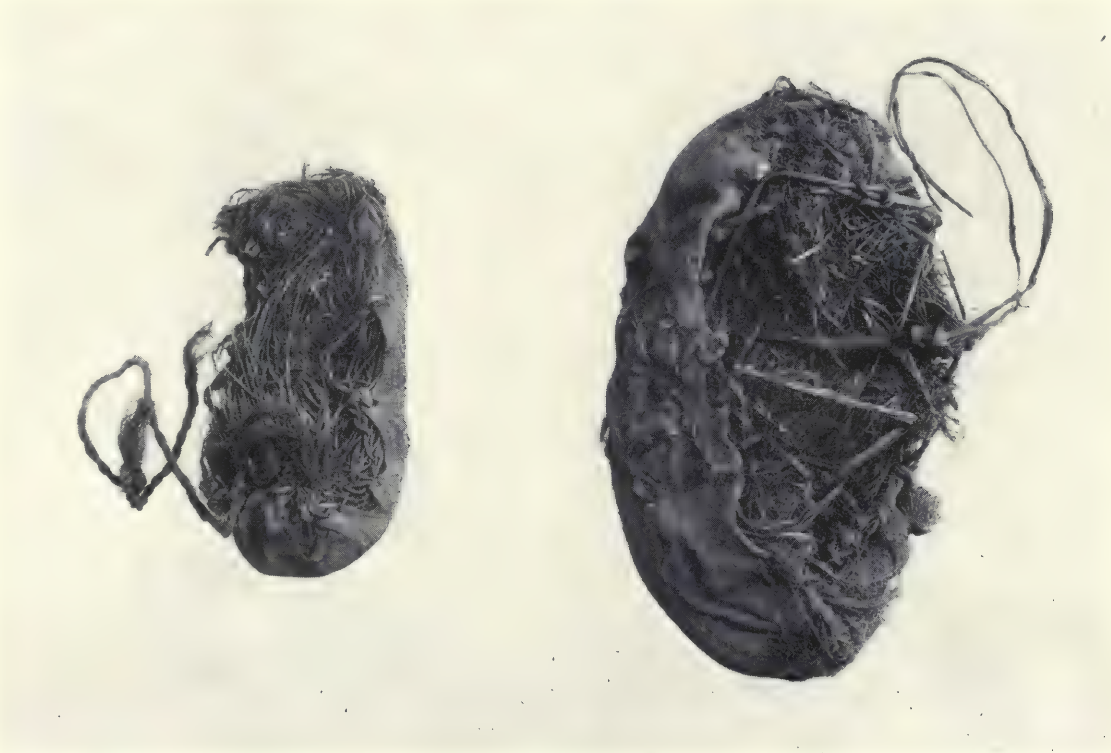


FIG. 110. Winter-type leather sandals with side-loop ties and grass "socks." Length of right sandal, 24.4 cm.

Manufacture.—Three pieces of leather, one on the bottom, and one on either side, form what seems to be the toe of a moccasin. They were sewed together with leather thongs.

The specimen is fragmentary, but the stitching and general appearance give the impression that it is the toe of a moccasin.

Occurrence by Phase, Tularosa Cave.—Pre-Pottery, 1 (fragment).

Cloth

PLAIN OVER-ONE-UNDER-ONE WEAVE CLOTH, BAST OR SURFACE FIBERS

Material.—Both the warp and weft strands were made of single-ply yarn of bast or surface (cotton) fiber; in a single piece of cloth both were made of the same type of fiber, as the two types apparently were never mixed. Bast fiber yarn was twisted to the right, an S-twist; while cotton fiber yarn was twisted to the left, a Z-twist. Usually the bast fiber yarn was heavier than the cotton yarn and as a result the cloth was heavier.

Manufacture.—Cloth fragments of bast fiber resembled modern burlap; those of cotton were finer. The thread count in bast fiber cloth varies from 4 and 5 to 7 and 7 threads per centimeter, with the median at 5 and 7 threads per centimeter. Cotton cloth thread count varies from 6 and 9 to 10 and 15 threads per centimeter, with the median at 9 and 9 threads per centimeter.

The majority of the fragments are not colored; however, one fragment of cotton cloth and two of bast were dyed black and one fragment of cotton and one of bast were dyed red.

One cloth fragment from Tularosa Cave had a geometric design of sawtooth lines and a key with interlocking triangles (Fig. 111). The design resembles some on the Reserve Black-on-White pottery and the original colors were probably blue or green, black, and white. The design was produced by using different-colored weft elements, which were interlocked at their common boundary, and by varying the under-one-over-one pattern by skipping warps.

Occurrence by Phases, Tularosa Cave.—San Francisco, 10 (4 bast, 6 cotton; 1 bast black, 1 cotton black); San Francisco-through-Tularosa, 17 (7 bast, 10 cotton; 1 bast red, 1 bast black, 1 cotton red, 1 woven three-color design); Reserve-through-Tularosa, 3 (all cotton).

NARROW FABRIC, PLAIN OVER-ONE-UNDER-ONE WEAVE

Material.—Warp and weft elements are 2-ply, Z-twisted, hard fiber cord.

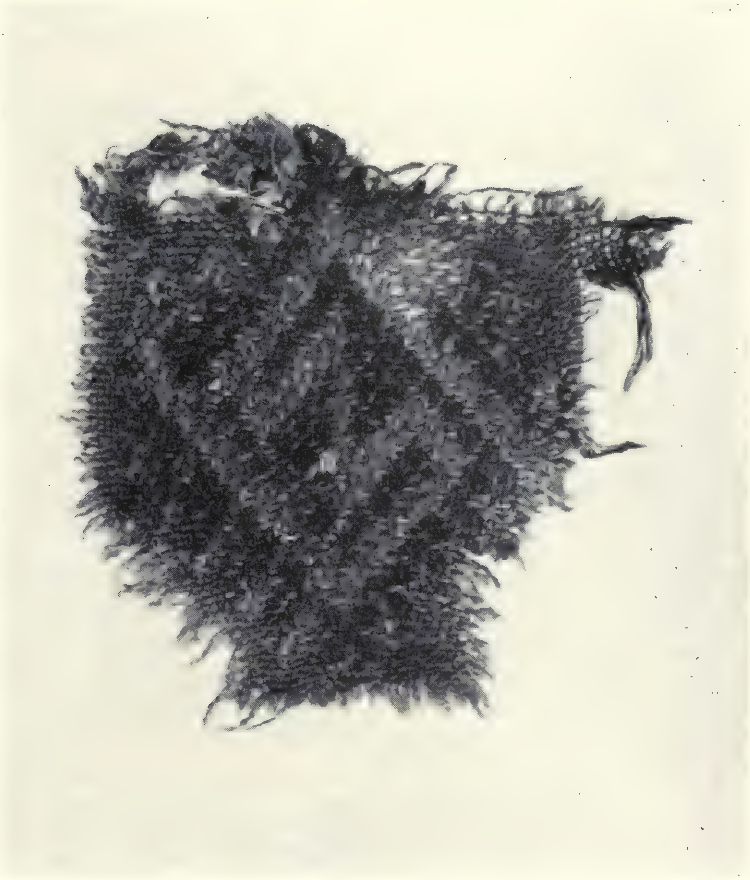


FIG. 111. Fragment of cotton cloth with geometric design woven in three colors. Length, 8.7 cm.

Manufacture.—Two warp elements were tied together in a square knot. Weft elements were woven back and forth in a plain over-one-under-one weave across the two warps.

The fragment averages 5 wefts per centimeter and is about 1 cm. wide.

Occurrence by Phase, Cordova Cave.—Pre-Pottery, 1 (fragment).

KNOTLESS NETTING OR PLAIN COILED NETTING (FIG. 112, *c*)

Material.—Elements are two-yarn, Z-twisted, bast fiber cord.

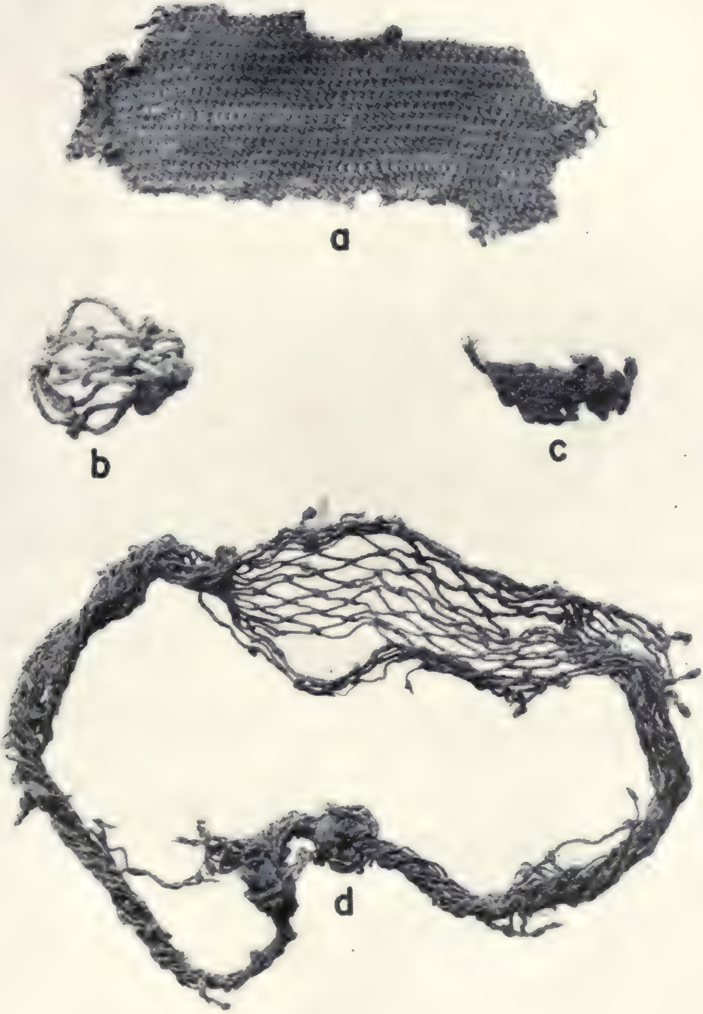


FIG. 112. Netting fragments: *a*, coiled netting on warps; *b*, netting tied with overhand knots; *c*, coiled or knotless netting; *d*, netting tied with lark's head knots. Length of *a*, 12.6 cm.

Manufacture.—The fabric is firmly made, with three coils per centimeter and three loops along each coil per centimeter. Each coil consists of a cord that forms a series of small loops. The loops of successive coils include the part of the cord between the loops of the immediately preceding coils.

Occurrence by Phase, Tularosa Cave.—Georgetown, 1.

Occurrence by Phase, Cordova Cave.—Late, 2.

COILED NETTING ON WARPS (FIG. 112, *a*)

Material.—Both warp and weft elements are two-yarn, Z-twisted bast fiber cord.

Manufacture.—The first coil consists of a weft element that forms a series of small loops through which a warp passes. The loops of the next weft element include a warp and the part of the weft between the loops of the preceding coil. Warps are always straight—merely caught in the loops of the weft. Weft loops are alternately spaced in adjacent rows. The warp elements serve to give the textile greater rigidity; it can be stretched along the bias, but, as with plain woven fabric, it stretches very little in the same direction as the warp.

There are 3 warps and 4 loops per centimeter in one fragment and 3 warps and 5 loops per centimeter in the other. Both are colored red.

Occurrence by Phases, Tularosa Cave.—San Francisco, 1; San Francisco-through-Tularosa, 1.

NETTING, LARK'S HEAD KNOTS (FIG. 112, *d*)

Material.—Elements are 2-ply, Z-twisted, surface fiber (cotton).

Manufacture.—The string is tied in lark's head knots to produce an 0.85 cm. mesh net. The net fragment was about 50 cm. long and 10 cm. wide, and the ends were tied together to produce a circular band of fabric.

Occurrence by Phase, Tularosa Cave.—Georgetown, 1.

NETTING, OVERHAND KNOTS (FIG. 112, *b*)

Material.—Elements are two-yarn, Z-twisted, bast fiber string.

Manufacture.—A 1.4 cm. mesh net was produced when a series of overhand knots were tied in the string, each knot including the cord between the knots of the row below. The resulting net is a small, tubular fragment about 5 cm. long, made of one continuous piece of string. The mesh is not rigid, as the overhand knots slip along the cord they include.

Occurrence by Phase, Tularosa Cave.—Pine Lawn, 1.

TWINED CLOTH, BAST FIBER

Material.—Both warps and wefts are two-yarn, Z-twisted, bast fiber cord.

Manufacture.—Paired weft elements are firmly twined in an over-one-under-one pattern down to the right, across the warp elements. The twined bag fragment from Tularosa Cave has 3 warps and 4 wefts per centimeter. A piece of two-yarn, Z-twisted, hard fiber string binds the edge at intervals ranging from 2 to 4 cm., passing through the fabric about 2 cm. from the edge. To reinforce this binding a narrow strip of yucca fiber binds the string to the edge of the cloth between the points where the string itself is fastened to the cloth. The fabric has a geometric design of horizontal bands and diagonal lines produced by using red, green, and natural-colored weft elements (Fig. 113).

The twined fragment from Cordova Cave is red in color, and has 4 warps and 5 wefts per centimeter.

Occurrence by Phase, Tularosa Cave.—San Francisco, 1.

Occurrence by Phase, Cordova Cave.—Late, 1.

TWINED CLOTH, HARD, BAST, AND HAIR FIBER

Material.—The warp is two-yarn, Z-twisted, hard fiber cord. Weft elements of one half of the textile are two-yarn, S-twisted, bast fiber cord and of the other half are two-yarn, S-twisted, hair cord.

Manufacture.—The fabric is firmly woven, with 4 warp and 10 weft threads per centimeter. One side of the fabric is woven with hair cord weft and hard fiber warp, and the other with bast fiber cord weft and hard fiber warp, producing light- and dark-colored halves of the textile. The hair and bast fiber weft elements are interlocked in the center of the fragment, between two warp elements.

Occurrence by Phase, Tularosa Cave.—San Francisco, 1.

TWINED CLOTH, FUR AND/OR FEATHER CORD

Material.—Warp elements are fur or feather quill (Type A-Q, p. 218) cord. Weft elements are two-yarn cord in six specimens, and feather quill cord in one.

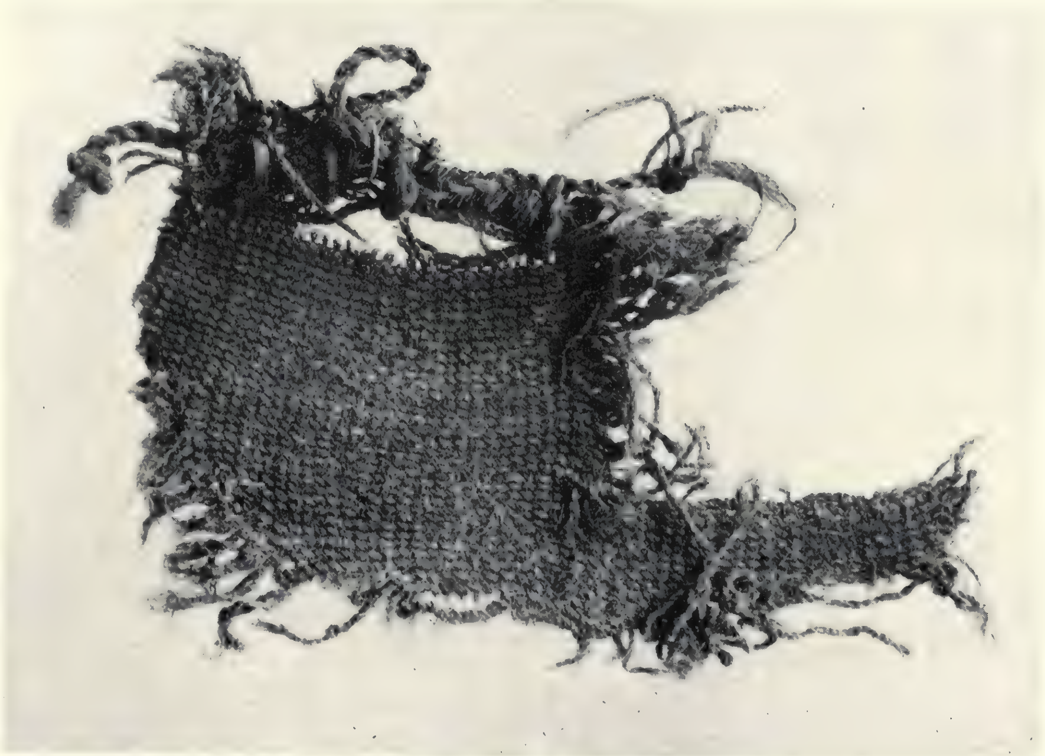


FIG. 113. Fragment of twined bag with design of horizontal and diagonal red and green stripes. Maximum width, 20.8 cm.

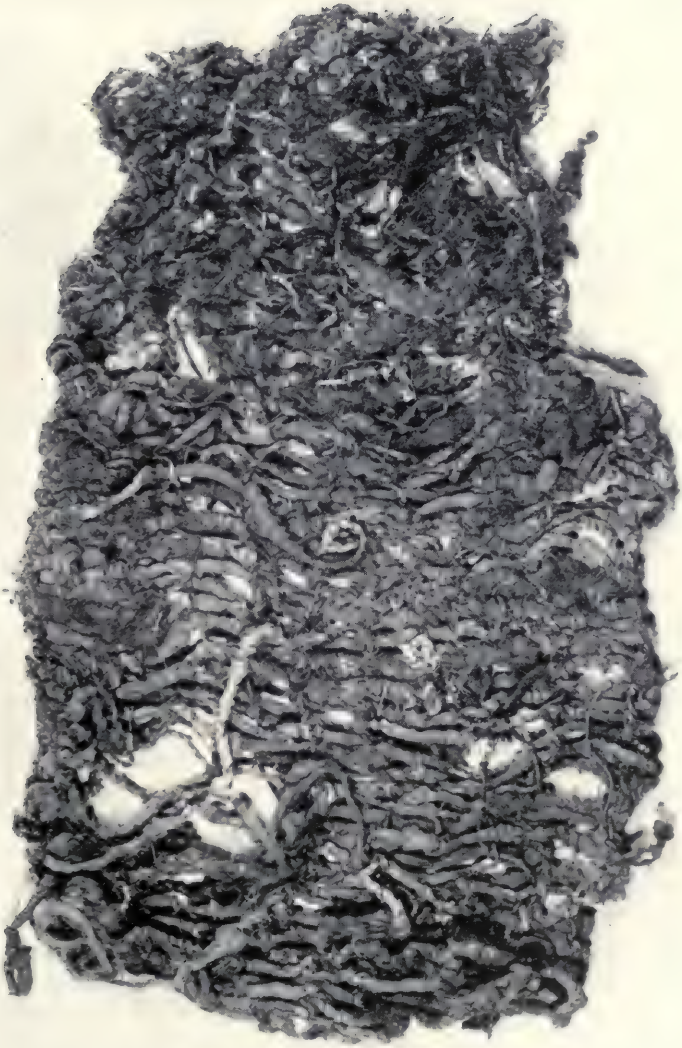


FIG. 114. Fur and feather cord blanket. Length, 85.0 cm.

Manufacture.—Warp elements are spaced about 2 cm. apart. They consist of a continuous strand of fur or feather cord, running back and forth across the blanket.

Every 8 to 10 cm. paired weft elements are twined across the warps, the first pair on either side being woven along the edge of the blanket. There is no evidence of special selvage treatment.

All the blankets have fur or feather cord warp and 2-ply cord weft except the complete one from the Georgetown Phase. This has fur cord warp and feather quill cord weft (Fig. 114).

Occurrence by Phases, Tularosa Cave.—Pine Lawn, 2 (1 fur blanket, 1 feather blanket, both fragments); Georgetown, 3 (1 complete fur and feather blanket, 2 fragmentary fur blankets); San Francisco, 1 fur blanket (fragment); San Francisco-through-Tularosa, 1 feather blanket (fragment).

Dimensions.—Length, 85.0 cm.; width, 48.0 cm.

Basketry

COILED BASKETRY

A. Two-rod-and-bundle foundation, bunched (Figs. 115, *a*, 117, top).

Material.—Rods are slender, woody shoots; sewing elements are flexible wood splints varying in width from 1.5 to 4 mm.

Manufacture.—The sewing splints include the two-rod-and-bundle bunched foundation of the coil and part of the bundle of the coil below. The stitch slant is /. Stitches are non-interlocking and only occasionally split. There are 2 coils and from 3 to 4 stitches per centimeter. The stitches are not evenly spaced, so that the distance between the sewing splints usually varies, and they never completely cover the foundation.

Two specimens from Tularosa Cave are center fragments; one is round, the other oval. The round center consists of a length of bundle, wrapped with sewing splints and bent into a circle. The two rods are then added to the foundation and coiling proceeds around the center. The center coil is held in place by several long stitches that include both it and the succeeding coil. The oval center consists of a length of foundation about 5 cm. long, wrapped with sewing splints. Subsequent coils are wound around this and fastened to it by the usual method; that is, the sewing splint includes the new coil and part of the bundle of the preceding coil.

Several splicing techniques for adding new splints are used in the two-rod-and-bundle basket fragments:

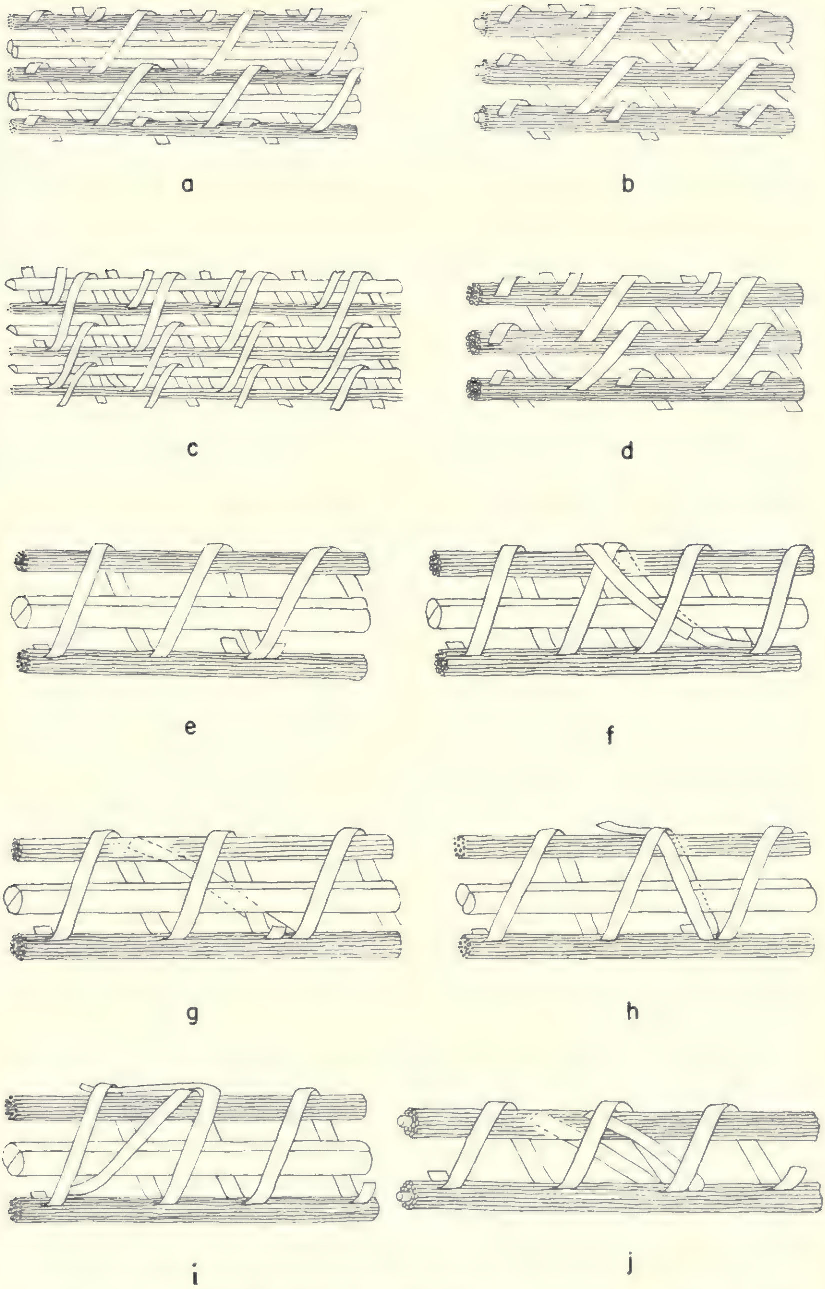


Fig. 115. Drawings showing construction of fragments of walls of coiled baskets: *a*, two-rod-and-bundle bunched foundation; *b*, bundle-with-rod-core foundation; *c*, half-rod-and-bundle foundation; *d*, bundle foundation; *e–j*, splicing techniques.

1. The most common type, known throughout the occupation of the caves, is also the simplest. The fag end of the new splint is cut off close to the working surface and the moving end of the old splint is clipped close to the reverse surface; the stub ends remain visible (Fig. 115, *e*).

2. In a wall fragment from a Pre-Pottery level of Tularosa Cave, the fag end of the new splint is carried along in the coil for a distance of one stitch before it begins encircling the coil, and the moving end of the old splint is worked back into the already sewed coil (Fig. 115, *f*).

3. In a specimen from the Plain Ware level of Cordova Cave, the moving end of the old splint is included in the coil secured by the new splint, and the fag end of the new splint is cut off close to the working surface (Fig. 115, *g*).

4. In a wall fragment from a San Francisco level of Tularosa Cave, the fag end of the new splint is included on the working surface of the coil it binds in place, and the moving end of the old splint is cut off close to the reverse surface (Fig. 115, *h*).

5. In a fragment from a San Francisco-through-Tularosa level of Tularosa Cave, the fag end of the new splint and the moving end of the old splint are both included in the coil to be secured by the splint (Fig. 115, *i*).

The variation in splicing technique suggests a lack of standardization of this aspect of basket manufacture. The first and simplest technique is found on the same specimen as the second, third, and fourth.

Only one specimen is complete enough to indicate shape and size. It has a slightly rounded bottom and flaring sides and is oval in cross section. It is 18 cm. deep, and 42 cm. across the longest diameter at the mouth. This basket was found in a Pre-Pottery level of Tularosa Cave.

One shallow bowl-shaped section of an unfinished basket was found in the San Francisco level of Tularosa Cave. It is 13.2 cm. in diameter and 2.5 cm. deep.

Occurrence by Phases, Tularosa Cave.—Pre-Pottery, 6 (5 fragments); Pine Lawn, 3 (fragments); Georgetown, 2 (fragments); Georgetown-through-San Francisco, 1 (fragment); San Francisco, 3 (fragments); San Francisco-through-Tularosa, 4 (fragments).

Occurrence by Phase, Cordova Cave.—Plain Ware, 2 (fragments).

B. Bundle-with-rod-core foundation (Figs. 115, *b*, 116, *b*, *d*, *f*).

Material.—The bundle is made of grass, hard fibers, or shredded yucca leaves with a slender woody shoot for a core. Sewing elements consist of flexible wood splints or strips of yucca averaging 2 to 3 mm. in width.

Manufacture.—The sewing splint encircles the bundle-with-rod-core foundation of one coil and part of the bundle of the coil below.

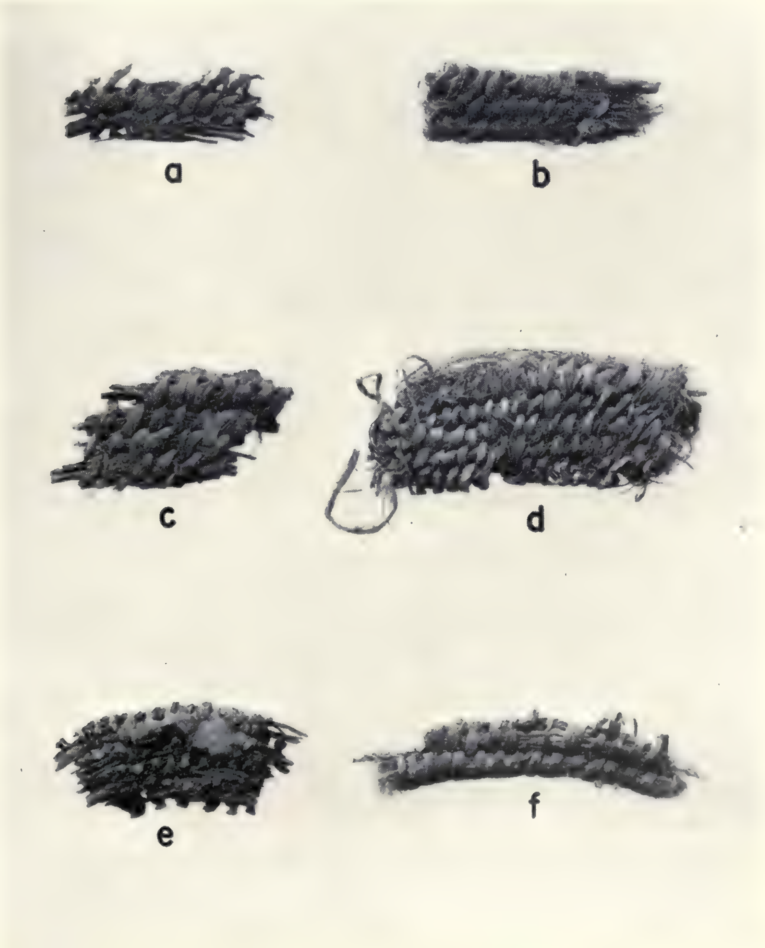


FIG. 116. Fragments of walls of coiled baskets: *a*, *c*, *e*, half-rod-and-bundle foundation; *b*, *d*, *f*, bundle-with-rod-core foundation. Length of *d*, 8.7 cm.

The stitch slant is /. Stitches are non-interlocking and are occasionally split. There are from 1½ to 2 coils and from 2 to 5 stitches per centimeter. The work is coarse, with uneven spaces between the stitches; the foundation is never completely covered by the sewing splints.

Information on splicing comes from one specimen found in a Pine Lawn Phase level of Tularosa Cave. The moving end of the old sewing splint and the fag end of the new are included on the reverse and work surfaces of the coil and bound by the new splint (Fig. 115, *j*).

Occurrence by Phases, Tularosa Cave.—Pre-Pottery, 1 (fragment); Pine Lawn, 1 (fragment); San Francisco, 1 (fragment).

Occurrence by Phase, Cordova Cave.—Late, 1 (fragment).

C. Bundle foundation (Figs. 115, *d*, 117, bottom).

Material.—The bundle consists of hard fiber or shredded yucca leaves. Sewing elements are flexible wood splints, 2 to 3 mm. wide.

Manufacture.—Non-interlocking stitches encircle the bundle foundation of the coil and part of the bundle of the coil below. The stitch slant is /.

Two small baskets of this type were found. One, from the San Francisco-through-Tularosa level, is 3.5 cm. in diameter and 1.5 cm. deep. There are 2 coils and 3 stitches per centimeter.

The other miniature basket was from the Georgetown-through-San Francisco level. It is 3.5 cm. in diameter and 1.0 cm. deep. There are 2 stitches and 1 coil per centimeter.

Both baskets are crude; the stitches are widely and unevenly spaced, and the foundation is easily seen. The center of each consists of a bundle bound by sewing splints and bent into a circle. Succeeding coils are then wrapped around the center, which is held in place by a few long stitches that include it and the succeeding coil.

Occurrence by Phases, Tularosa Cave.—Georgetown-through-San Francisco, 1 miniature basket; San Francisco-through-Tularosa, 1 miniature basket.

Dimensions.—Diameter, 3.5, 3.5 cm.; depth, 1.5, 1.0 cm.

D. Half-rod-and-bundle foundation (Figs. 115, *c*, 116, *a*, *c*, *e*).

Material.—The rods are slender woody shoots split longitudinally; the bundles are made of grass or fiber. Sewing elements are flexible wood splints varying in width from 2 to 4 mm.

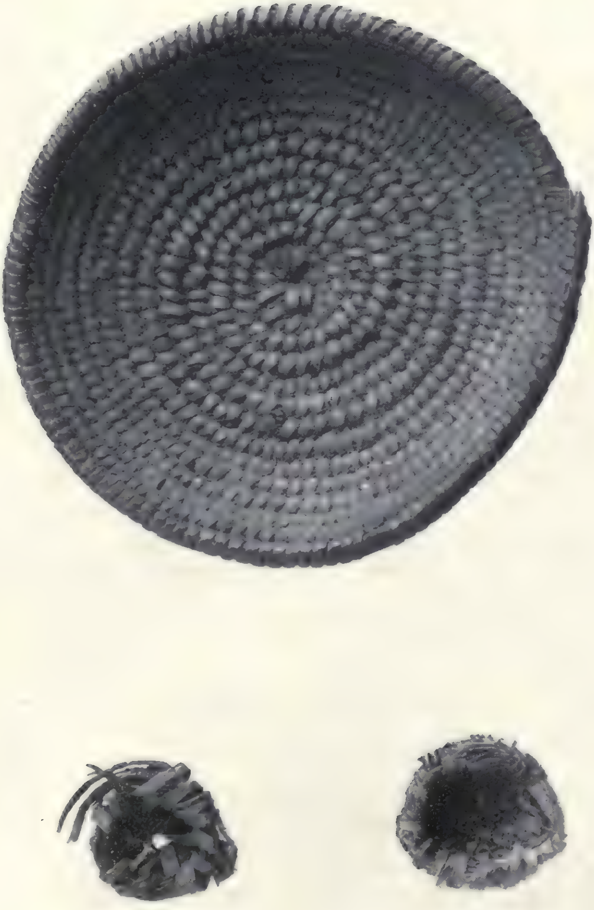


FIG. 117. Coiled baskets: top, shallow fragment with two-rod-and-bundle bunched foundation; bottom, miniature baskets with bundle foundation. Diameter of fragment at top, 12.8 cm.

Manufacture.—The sewing splint includes the half-rod-and-bundle foundation of the coil and part of the bundle of the coil below. Stitches are non-interlocking. The stitch slant is /. There are 1½ to 2 coils and 2 stitches per centimeter. The work is coarse, with wide, uneven spaces between the stitches; and the foundation is not entirely covered.

Occurrence by Phases, Tularosa Cave.—Georgetown-through-San Francisco, 2 (fragments); San Francisco, 1 (fragment); San Francisco-through-Tularosa, 1 (fragment).

Occurrence by Phases, Cordova Cave.—Pre-Pottery, 1 (fragment); Plain Ware, 1 (fragment); Late, 1 (fragment).

TWILLED RING BASKETRY (FIG. 118)

Material.—Elements are narrow strips of sotol (*Dasylirion wheeleri*), which average 4 mm. in width.

Manufacture.—Basket walls are woven in an over-three-under-three pattern. Along the edge, the elements are bent over a stick about 1.0 cm. in diameter. These ends are bound in place with strips of yucca leaves, woven in a twined weave. Part of the ends of the elements are then plaited into a four-element braid in an over-two-under-two pattern, parallel to the edge of the basket. The rest of the elements are cut off even with the edge of the braid.

Occurrence by Phases, Tularosa Cave.—San Francisco-through-Tularosa, 1 (fragment); Reserve-through-Tularosa, 1 (fragment).

TWINED BASKETRY

A. Tied-twined basketry (Fig. 119).

Material.—The foundation is a bundle of grass, which varies in thickness from 2 to 2.5 cm. Twining elements are narrow strips of yucca leaves.

Manufacture.—The bundle of grass forms a coil that spirals out and up from the center of the basket. Coils are tied-twined together by weft elements radiating out from the center, from 4 to 8 cm. apart.

The basket is ovoid in horizontal and vertical cross section. It has a flat, oval cover slightly larger than its mouth.

Occurrence by Phase, Tularosa Cave.—Pre-Pottery, 1.

Dimensions.—Basket diameter, maximum 58 cm., minimum 44 cm.; mouth diameter, maximum 27 cm., minimum 18 cm.; height, 37 cm.

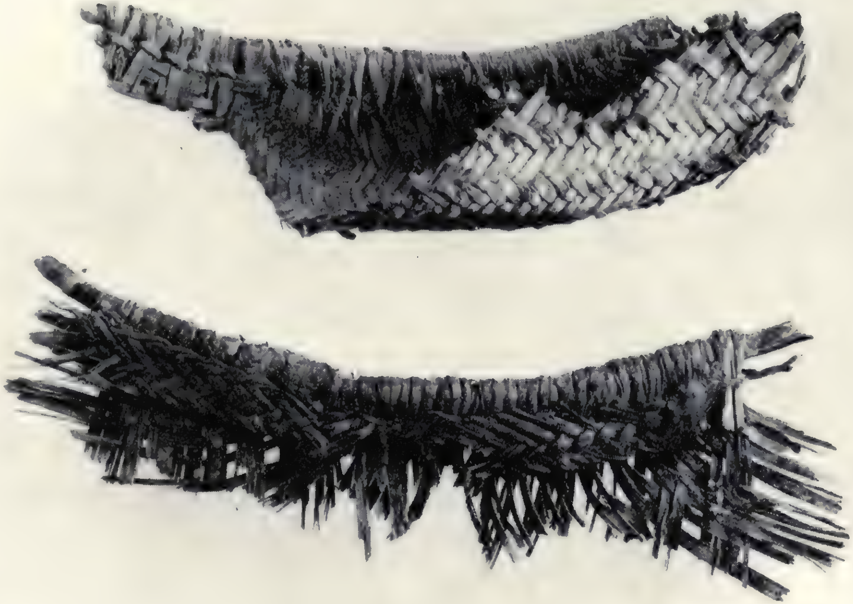


FIG. 118. Fragments of twilled ring baskets. Width of fragment at bottom, 24.0 cm.

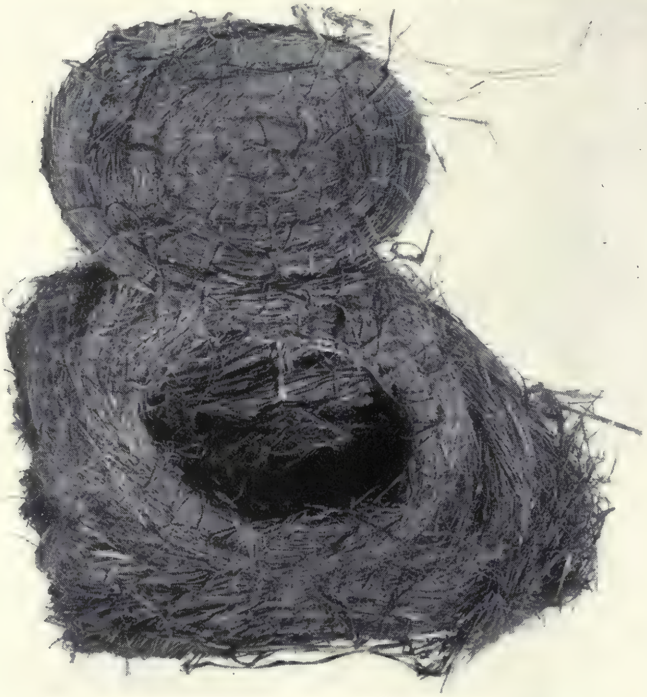


FIG. 119. Tied-twined basket with grass bundle foundation. Maximum diameter, 58.0 cm.

B. Twined carrying basket, flexible warp (Fig. 120).

Material.—Warp elements are whole yucca leaves (*Yucca baccata* Torr.); wefts are narrow strips of yucca leaves.

Manufacture.—Warp elements are placed parallel to one another about 1 cm. apart and are folded under at both ends. Weft elements are twined across the warps at intervals of about 4 cm. near the ends and from 8 to 10 cm. in the middle of the basket. This mat-like fabric is then pulled into a cylindrical shape and laced together across the top and bottom, and down the open side, with a network of strips of yucca leaves.

Occurrence by Phase, Tularosa Cave.—Pine Lawn, 1.

Dimensions.—Length, 60 cm.; width, 36 cm.

C. Twined basket, rigid warp (Fig. 121, top).

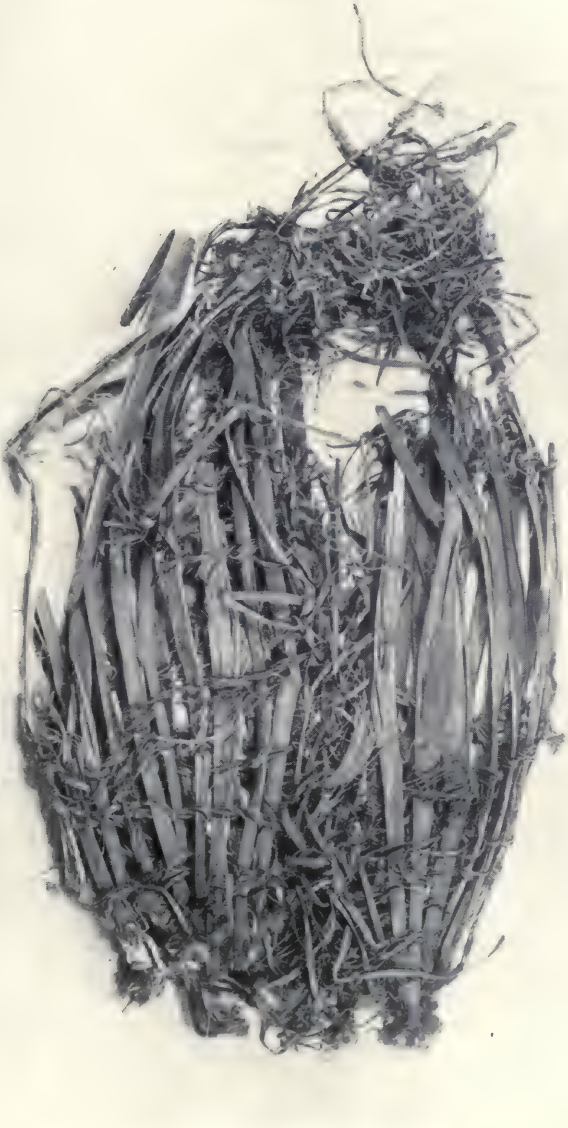


FIG. 120. Flexible twined carrying basket of yucca. Length, 60 cm.

Material.—Warps are rigid woody shoots, from 3 to 4 mm. in diameter; wefts are flexible wood splints, from 2 to 3 mm. wide.

Manufacture.—Paired weft elements are twined over-two-under-two warp elements, with stitches slanted down to the left. Each succeeding pair of weft elements pass over and under the same two warps. Adjacent weft elements are close together, but the foundation is not completely covered.

Occurrence by Phase, Cordova Cave.—Late, 3 (fragments).

D. Diagonal (twilled) twined basketry, rigid warp (Fig. 121, bottom).

Material.—Warps are rigid woody shoots, from 3 to 4 mm. in diameter; wefts are flexible wood splints, from 2 to 3 mm. wide.

Manufacture.—Paired weft elements are twined over-two-under-two warp elements, with stitches slanted down to the left. Each succeeding pair of weft elements moves over one warp to the left, producing a diagonal pattern.

At the rim, the warp elements are folded over, and they are held in place by the top one or two rows of weft, which include them. The rim is bound with additional sewing splints.

All three fragments of this type are covered with pitch, suggesting that they are fragments of a water bottle. They are similar to historical Apache water bottles in construction, and were found in association with the cache of hides (Chapter XI).

Occurrence by Phase, Cordova Cave.—Late (Apache?), 3 (fragments).

Cradles

FLEXIBLE CRADLES (FIG. 122)

Material.—Warp elements are sotol (*Dasylirion wheeleri*); weft elements and netting are strips of yucca leaves (*Yucca baccata* Torr.).

Manufacture.—Warp elements, consisting of individual sotol leaves, are cut longer than the length of the cradle and folded over a strip of yucca at the top. At the bottom they are grouped together in bunches of three or four, and at intervals two of these bunches are tied together with square knots.

Weft elements are twined over-one-under-one across the warp elements at intervals varying from 6 to 10 cm. The twining is loose enough to hold the warp elements about 1 cm. apart. About

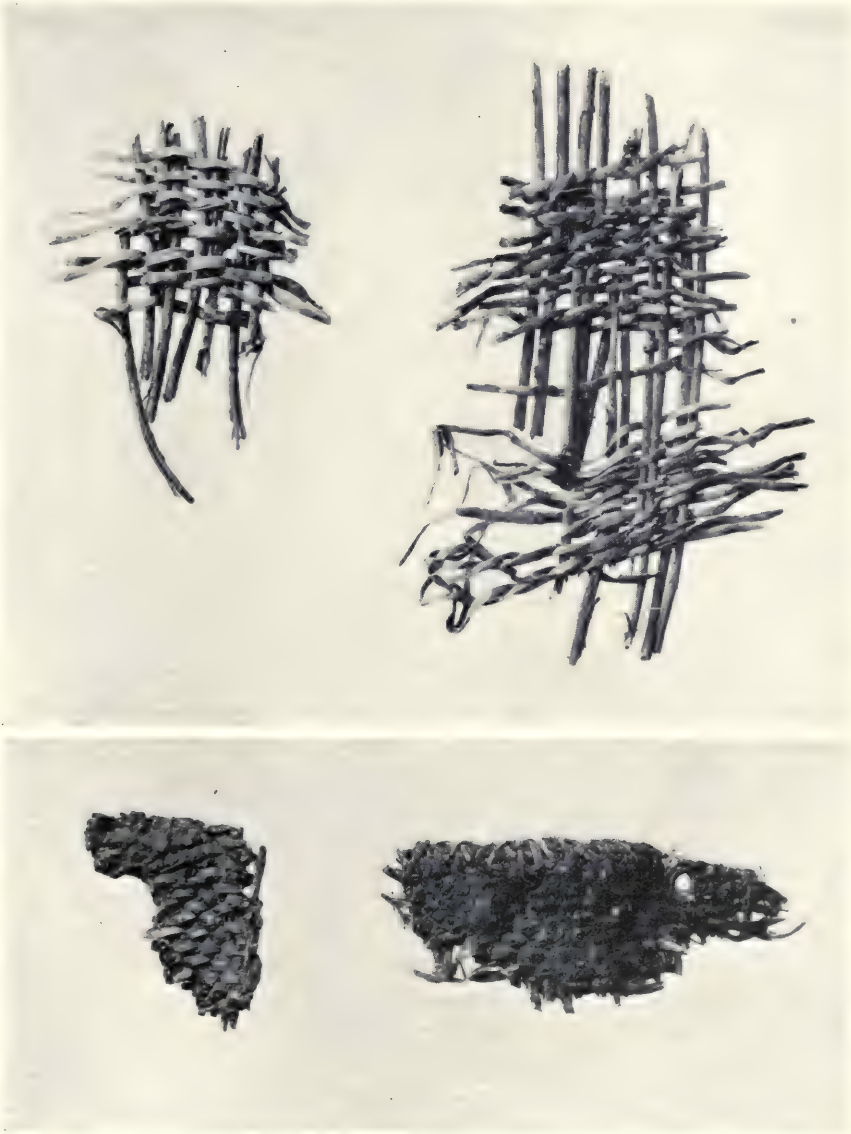


FIG. 121. Rigid twined basketry: top, plain over-two-under-two twined fragments; bottom, fragments of diagonal (twilled) twined basket. Length of fragment at lower right, 6.1 cm.

3 cm. from the top of the cradle there is one row of tied-twining, which holds the warp elements and the folded ends in place. Ends of the weft elements are twisted together and combined with other pieces of yucca leaves to produce a loop between each weft row along the edges of the cradle.

The yucca leaf strips, over which the warp elements are folded at the top of the cradle, are pulled up and tied in a square knot. The knotted warp elements at the bottom of the cradle are also tied together with yucca strips, creating a somewhat egg-shaped cradle. Across the bottom and lower part of the front of the cradle is a loose netting of yucca strips, which are twisted and tied at intervals with square knots. This netting extends for a distance of about 34 cm. up the front of the cradle and ties on either side to the loops produced by twisting the ends of the weft elements and tying them together. There is a similar net extending down from the top for a distance of 16 cm. The cradle is filled with a bedding of grass.

Occurrence by Phases, Tularosa Cave.—Pre-Pottery, 1 (complete); Pine Lawn, 1 (fragment); Georgetown, 1 (fragment).

Dimensions.—Length, 80 cm.; circumference, 71 cm.

RIGID CRADLE(?) (FIG. 123)

Material.—Peeled sticks about 5 mm. in diameter form the framework; twining elements are of two-yarn, Z-twisted, hard fiber cord. Flexible wood splints are used to bind sticks in place.

Manufacture.—The framework is made of a series of parallel sticks twined together with a cord about 5 mm. from one end. Another stick is laid on top of this framework along the edge, and a strip of yucca leaf is along the end, folded to extend under the parallel sticks for a distance of about 5 mm. Flexible wood splints bind this stick and the yucca leaf to the original framework. Some of the stitches of this binding pass between the parallel sticks and others are sewed through the sticks, anchoring them in place. Another stick of the same size is placed on top of the framework next to the one already bound in place, and it is lashed to the original elements of the framework with two-yarn cord that alternately winds around the framework and the stick.

This specimen is only a small fragment, but it resembles rigid cradle frames found elsewhere.

Occurrence by Phase, Tularosa Cave.—San Francisco-through-Tularosa, 1 (fragment).

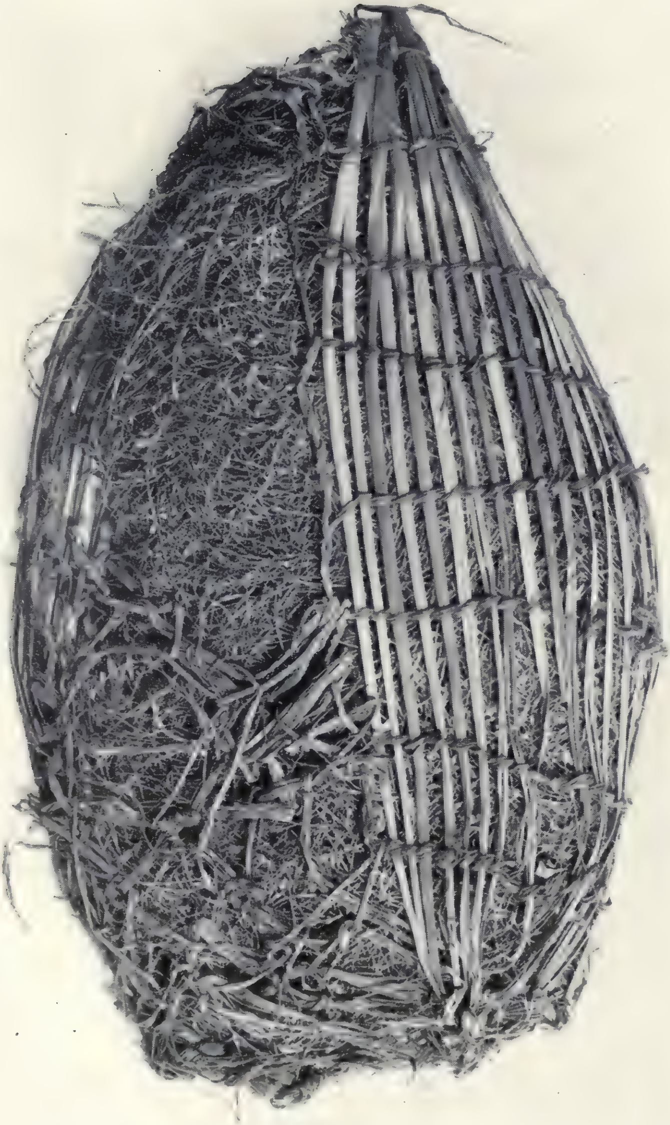


FIG. 122. Flexible cradle with grass bedding, from Pre-Pottery Phase, Tularosa Cave. Length, 80.0 cm.

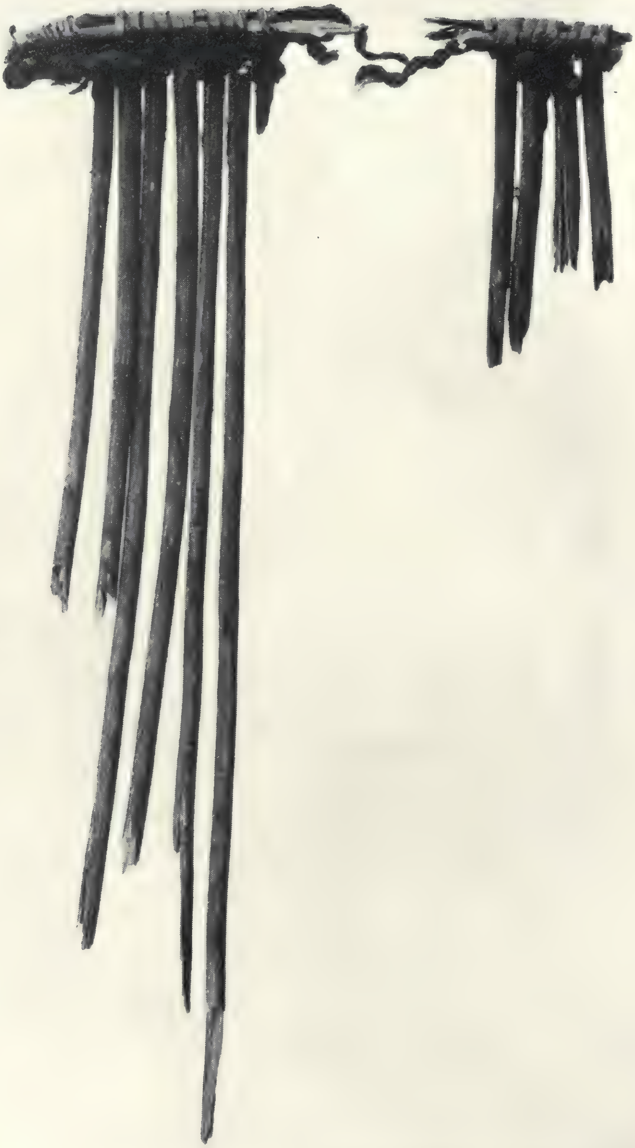


FIG. 123. Fragment of rigid cradle. Maximum length, 30.0 cm.

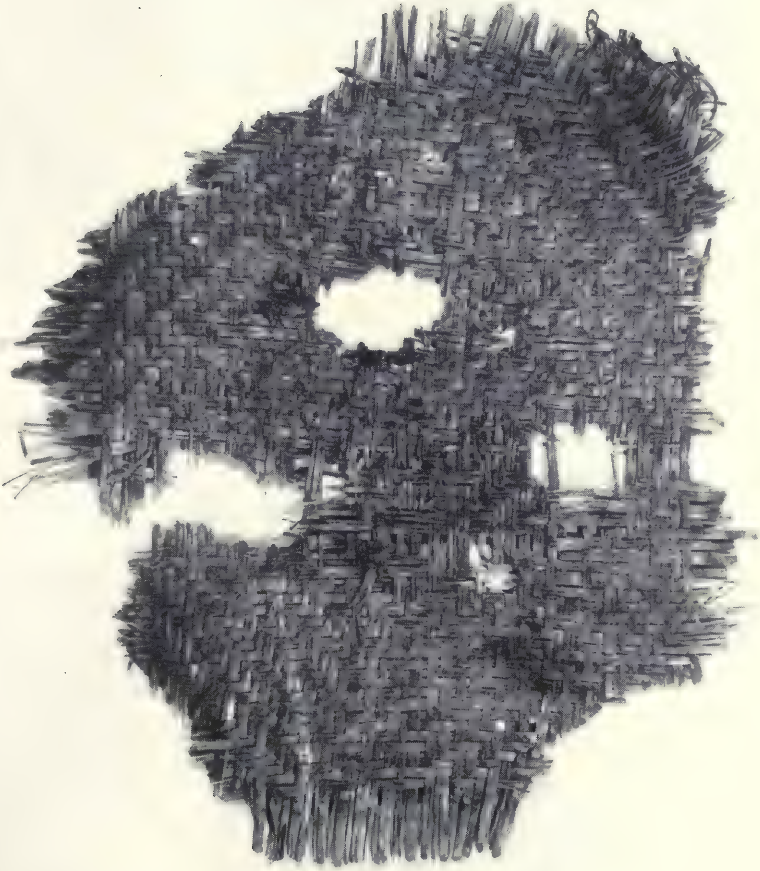


FIG. 124. Twilled mat. Note selvage treatment in upper right corner. Length, 66 cm.

Matting

TWILLED MATTING (FIGS. 124, 125)

Material.—Elements are long strips of yucca or rushes (*Yucca, Scirpus, Dasylirion,* or *Nolina*), which vary in width from an average of 2 mm. in a finely woven mat to 8 mm. in a heavier, coarser mat.

Manufacture.—Four mat fragments are woven in an over-three-under-three pattern and three in an over-two-under-two pattern.

Only one specimen has any indication of a selvage or finished edge. The elements running parallel to the edge of the mat are turned in a 90-degree angle toward the edge, and combined with those running perpendicular to the edge. At a distance of about 4 cm. from the edge of the weaving, the ends are folded under and fastened in place by two narrow strips of yucca, woven in and out in a loose, twined weave.

These mat fragments are well made and firmly plaited. The weaving is tight, with very little space between the elements.

Occurrence by Phases, Tularosa Cave.—Georgetown, 1 (fragment); San Francisco, 1 (fragment); San Francisco-through-Tularosa, 4 (fragments); Reserve-through-Tularosa, 1 (fragment).

TWINED AND SEWED MATTING (FIG. 126)

Material.—Warp elements are rushes (*Scirpus validus*); weft elements are two-yarn, hard fiber cord.

Manufacture.—Each warp element, which consists of a bunch of 3 or 4 rushes, is from 10 to 12 cm. longer than the mat and is folded over at each end. These folded ends, from 4 to 5 cm. long, are combined with the long section of the adjacent warp when the weft elements are twined along the edge. The folding reinforces the edge of the mat, making it thicker than the center. The outer warp on either side is a three-ply braid of rushes.

Rushes in the center of the mat are joined by a type of sewing where the two-yarn cord weft goes through the center of each rush. Weft elements are spaced at intervals of 15 or 16 cm. across the center of the mat. About 5 mm. from the edge, on either end, weft elements are twined in an over-one-under-one pattern. Weft elements extend beyond the width of the mat, are twisted together several times, and then are twined back across the mat about 6 cm. from the edge, in an over-three-under-three pattern.

Occurrence by Phases, Tularosa Cave.—Pine Lawn, 1 (complete); Georgetown, 5 (fragments).

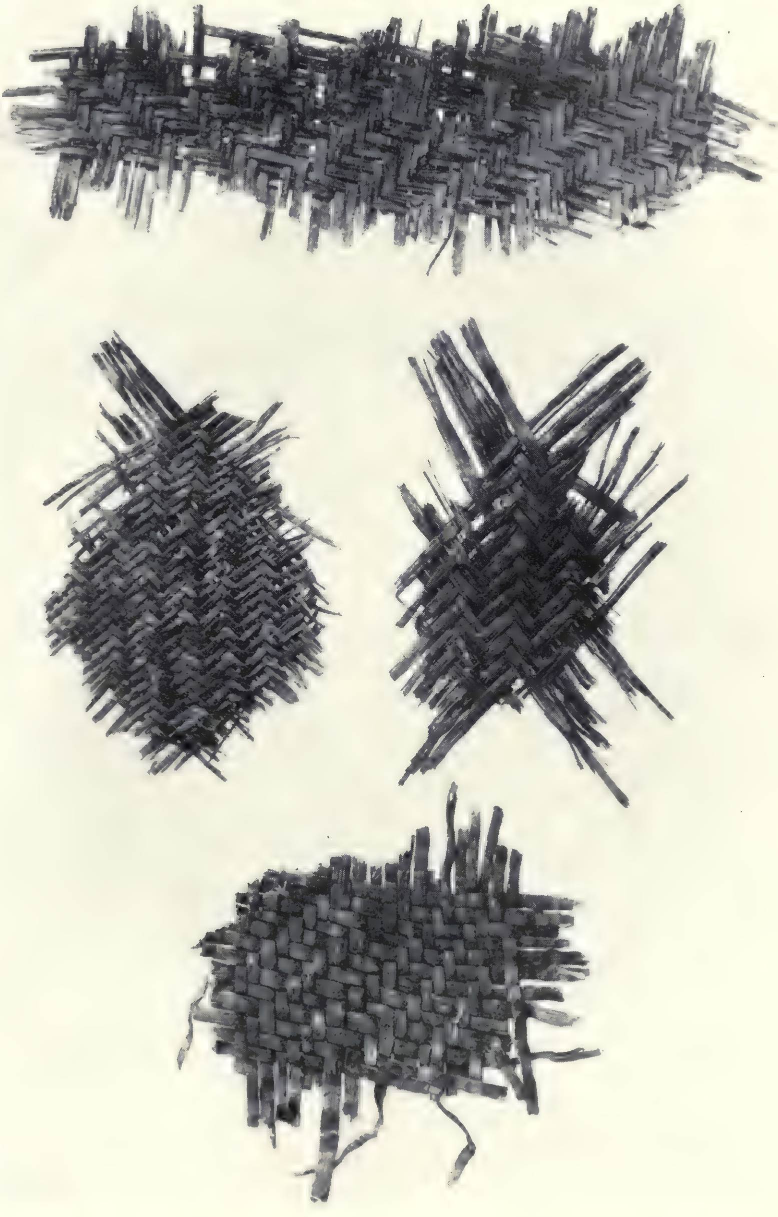


FIG. 125. Fragments of twilled mats. Width of fragment at top, 26 cm.

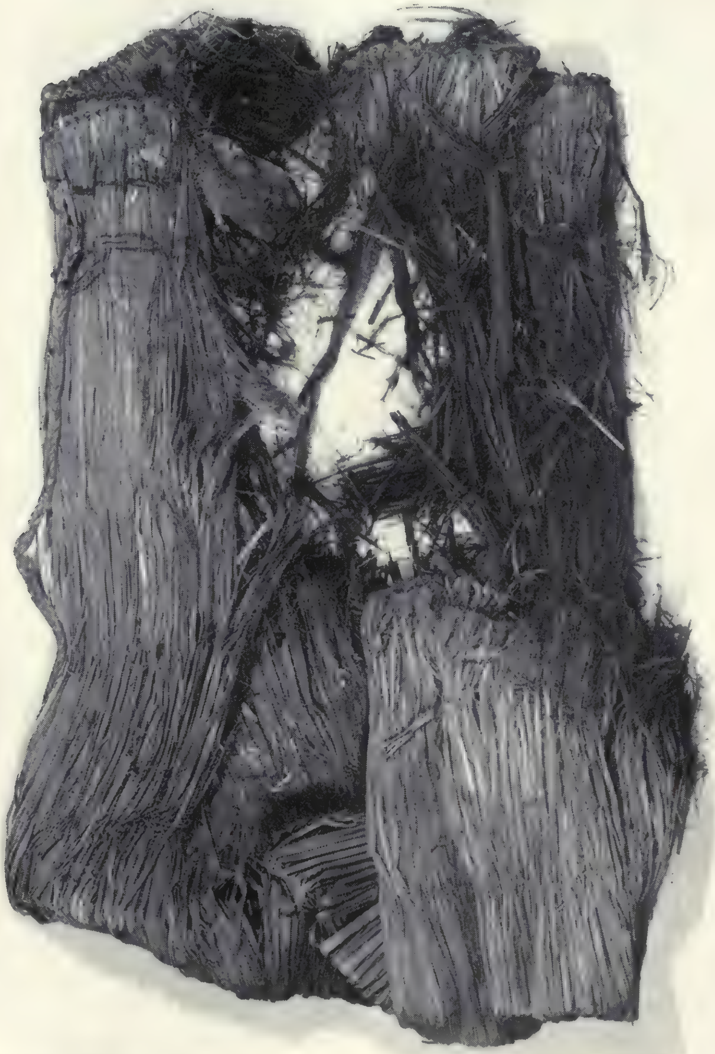


FIG. 126. Twined and sewed mat associated with Burial 2. Length, unfolded, 122 cm.

Occurrence by Phases, Cordova Cave.—Late, 1 (fragment).

Dimensions.—Length, 122 cm.; width, 113 cm.

String Aprons

ELEMENTS BOUND TOGETHER (FIG. 127, LOWER LEFT, RIGHT)

Material.—The elements are two-yarn, bast fiber cords.

Manufacture.—One string apron, from the Georgetown Phase, was found with a burial (No. 2, Tularosa Cave). The string has been wound into a series of loops, some about 60 cm. long, others about half that length, so that it resembles a hank of yarn with loops of different lengths. At the top, the hank is bound together with another string, which is wound tightly around it.

Another fragment of a string apron was found in the San Francisco-through-Tularosa level. It consists of doubled strings; the doubled ends are folded over for a distance of about 2.5 cm. This entire, thick bundle is bound together with another string, which winds tightly around it. The loose ends of the doubled string hang down below this. The string in this apron is dyed red.

Occurrence by Phases, Tularosa Cave.—Georgetown, 1 (complete); San Francisco-through-Tularosa, 1 (fragment).

ELEMENTS TWINED TOGETHER (FIG. 127, UPPER LEFT)

Material.—The elements are two-yarn, hard fiber cords.

Manufacture.—Doubled cords are folded over a heavier cord for a distance of about 1 cm. and fastened in place by another pair of cords, woven in and out in a twined weave. The loose ends of the doubled strings hang below.

Occurrence by Phase, Tularosa Cave.—Georgetown, 1.

Sash (Fig. 128)

Material.—Elements are two 2-strand, S-twisted cords of animal hair, combined in an S-twist.

Manufacture.—A hank of cord has been loosely twisted to form a Z-twisted rope, consisting of 17 elements. A 4-strand cord is drawn through the loop at one end and an 8-strand cord through the other. Both are tied and twisted to form tapering ends, which prevent the sash from untwisting.

The sash was found around the waist of the mummy. One end went around once, and the remainder was doubled and put around

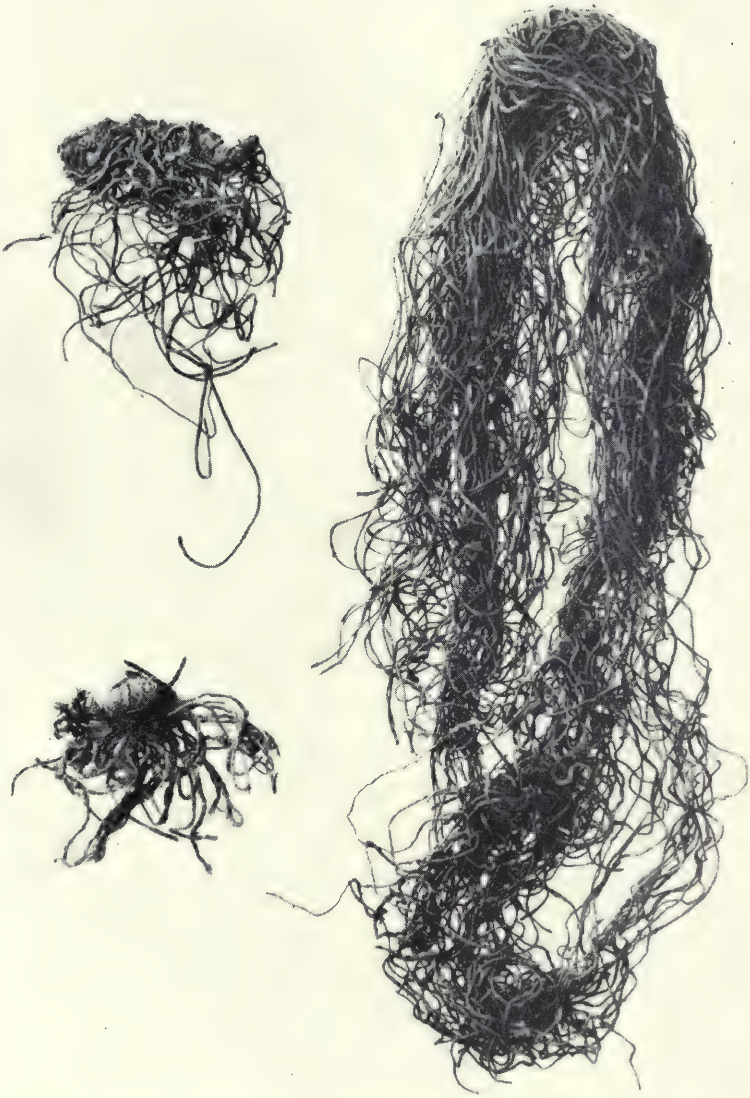


FIG. 127. String aprons: upper left, elements twined together; lower left and right (right associated with Burial 2), elements bound together. Maximum length of specimen on right, 50 cm.

again. The doubled end and the two loose ends were tied in a square knot.

Occurrence by Phase, Tularosa Cave.—Pine Lawn, 1.

Dimensions.—Length, 166 cm.

Burden Strap (Fig. 129, top)

Material.—Warp elements are bear grass (*Nolina*); wefts are two-yarn, Z-twisted and S-twisted hard fiber cords.

Manufacture.—Eighteen parallel warp elements are held together by a two-yarn, Z-twisted cord, twined across them in an over-two-

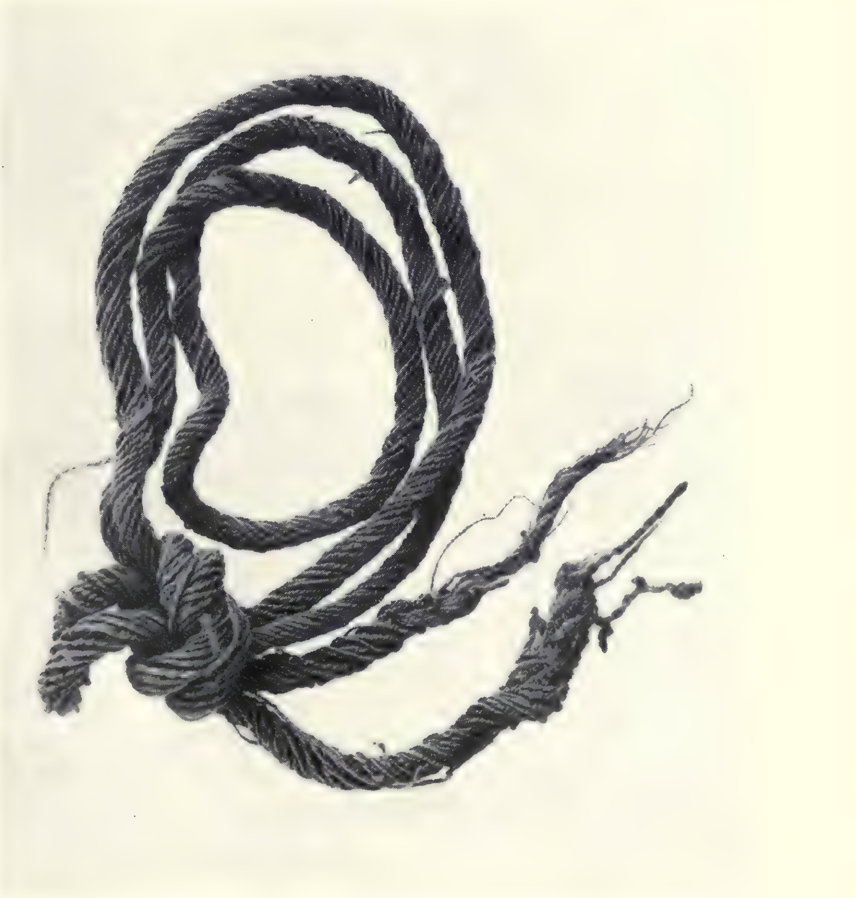


Fig. 128. Sash of twisted animal-hair cord, associated with Burial 2.

under-two pattern about 4 cm. from one end. The ends of the warp are then folded over a thin twig for a distance of about 3 cm. and made fast by another two-yarn, Z-twisted cord that catches the body of the warp and the folded ends in a twined over-four-under-four weave, just below the twig.

About 2 cm. from the twig, a two-yarn, S-twisted weft element is woven across the warp in a plain over-one-under-one weave. The ends of the weft are carried along the edge of the warp on either side, and at 2 cm. intervals both are woven across the warp again.

Occurrence by Phase, Cordova Cave.—Plain Ware, 1 (fragment).

Dimensions.—Length, incomplete; width, 4.5 cm.

Pad (Fig. 129, bottom)

Material.—Warp elements are bundles of single-ply, S-twisted, hard fiber yarn; wefts are 2-ply, S- and Z-twisted bast fiber cord.

Manufacture.—Five bundles of short strings, 7 cm. long, and varying in width from 2 to 4 cm., are fastened together by another cord, which is tied-twined across them in about the center. The resulting pad is further bound together by cords that encircle the twined elements, passing through the loose ends of the bundles of yarn.

Occurrence by Phase, Tularosa Cave.—San Francisco-through-Tularosa, 1.

Dimensions.—Length, 16 cm.; width, 7 cm.; thickness, 2 cm.

Basketry-, Mat-, and Cloth-Impressed Sherds (Fig. 23)

UNFIRED, COILED, BASKETRY-IMPRESSED SHERDS

Thirty unfired, fiber-tempered sherds with coiled basketry impressions were found in Tularosa Cave. While the foundation of the baskets cannot be determined, the number of the coils and stitches per centimeter can be measured. There are from 2 to 3 coils and 3 to 4 stitches per centimeter, just as in the coiled basket wall fragments found in the cave.

Occurrence by Phases, Tularosa Cave.—Pre-Pottery, 1; Pine Lawn, 1; Pine Lawn-through-Georgetown, 1; Georgetown, 8; San Francisco, 13; San Francisco-through-Tularosa, 6.

TWILLED MAT OR BASKET-IMPRESSED SHERDS

Two unfired sherds had twilled mat or basket impressions. One was woven in an over-two-under-two pattern, with elements 8 mm.

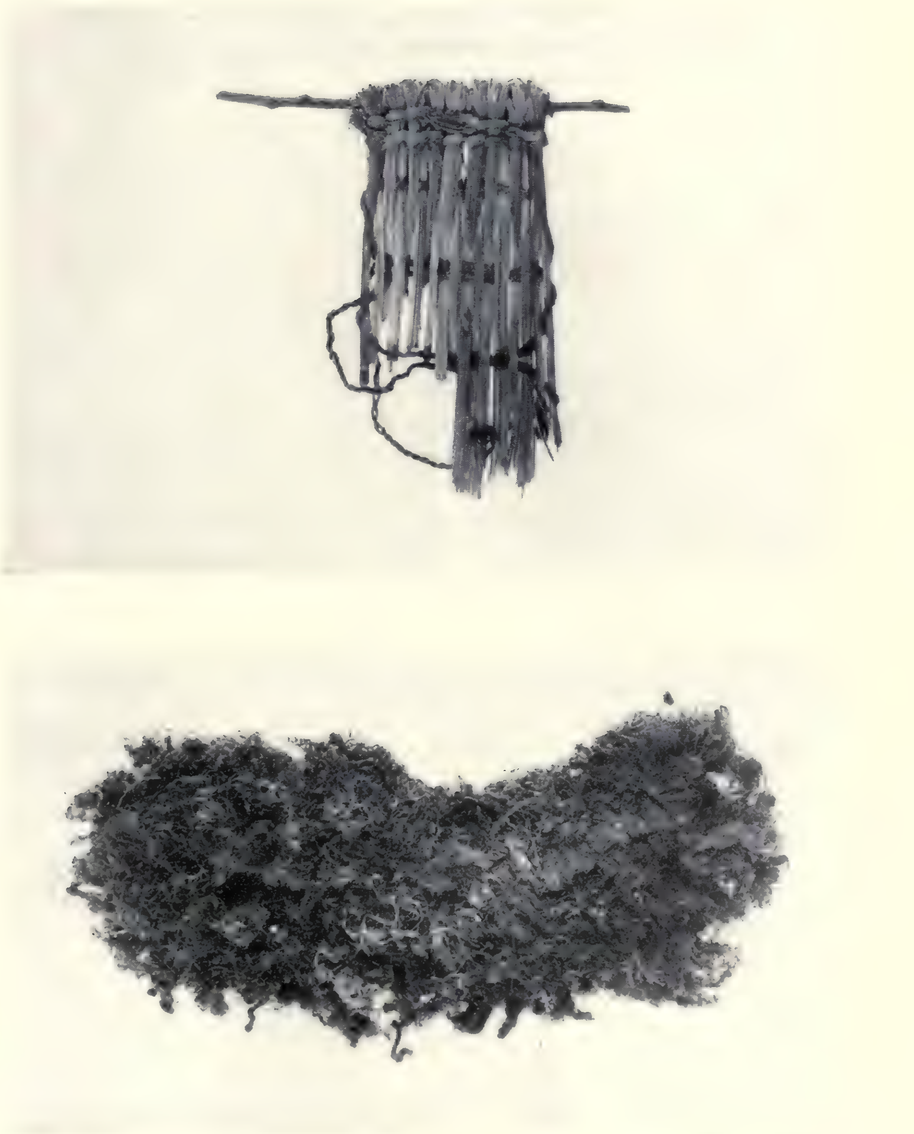


FIG. 129. Top: fragment of semi-rigid burden strap. Bottom: pad. Length of pad, 16 cm.

wide; the other was woven in an over-three-under-three pattern with elements 8.5 mm. wide.

Occurrence by Phases, Tularosa Cave.—San Francisco, 1; San Francisco-through-Tularosa, 1.

CLOTH-IMPRESSED SHERD

One unfired sherd had a cloth impression. The textile was finely woven in an over-one-under-one pattern.

Occurrence by Phase, Tularosa Cave.—Georgetown, 1.

VII. Wooden Artifacts

By Roger Grange, Jr.

Discussion

The analysis of the wooden artifacts recovered from strata in Tularosa and Cordova caves presents evidence for cultural continuity and change during the occupation of the sites. Moreover, these materials provide an opportunity to test one of the working hypotheses of Southwestern archaeology, the concept of the Mogollon as a distinct cultural entity, by comparing these Mogollon wooden artifacts with those from other Southwestern cultures.

The suggestion has been made that there are not enough distinctive traits to justify classifying Mogollon as a valid concept (Brew and Danson, 1948, p. 211). It has also been asserted that "... the picture has been colored by the fact that in Basketmaker sites wood, fur, feathers, fiber, etc., have been found, which is not true of comparable sites in the Mogollon. After removing the perishable items from the Basketmaker assemblage we see that there are many similarities between the Mogollon and Anasazi prior to 700 A.D." (H. G. Smith, 1949, p. 68.) The excavation of Tularosa and Cordova caves resulted in a collection of Mogollon perishable artifacts that fill the gap in the available data and make possible a reassessment of the concept of the Mogollon culture on the basis of new evidence. The wooden artifacts have been utilized for this purpose.

Current syntheses of Southwestern archaeology provide the general background for this test of the Mogollon hypothesis (McGregor, 1941b; Martin, Quimby and Collier, 1947; Martin and Rinaldo, 1951). The trait similarities and differences in imperishable remains, culture sequences, spatial distributions, regional specializations and inter-relationships of Anasazi, Hohokam and Mogollon have been fully discussed by many authors.

Some Anasazi sites that contained wooden artifacts have tree ring dates (McGregor, 1941b, Appendix 1; Smiley, 1951; Haury, 1945b, p. 19) while others have been placed in relative chronological sequence through trait comparisons and classifications noted in the site reports. Hohokam sites from which wooden artifacts were recovered have been placed in the relative chronological framework by similar classificatory methods (Haury, 1945a, pp. 162, 193; 1950, p. 546).

Previous discussions of the Mogollon concept have centered around its relationships with Anasazi and Hohokam, and consequently this test of the Mogollon hypothesis will be primarily concerned with comparisons of wooden artifacts from these three cultures. There are, however, in areas peripheral to the Southwest proper, culture manifestations that must also be considered in the comparative analysis.

There are two reasons for including these peripheral areas in this study:

(1) Relationships of the peripheral cultures with Anasazi or Mogollon have been postulated on the basis of the imperishable remains. A test of the Mogollon hypothesis must include a study of all possible Mogollon relationships.

(2) Comparisons of wooden artifacts from peripheral areas with those of the Southwest proper will provide a broader basis for the assessment of the significance of similarities and differences noted among wooden artifacts of Anasazi, Hohokam, and Mogollon.

These peripheral regions include portions of Mexico, the Trans-Pecos area of western Texas, the Oklahoma Panhandle, the Ozark Bluffs of Missouri, and the Great Basin (Nevada, northern Utah and Oregon).

The following summaries indicate the sources for culture sequence, relative chronological position of sites in the peripheral areas and the postulated relationships with the Southwest.

Mexico

Coyote Burial Cave is mentioned by Cosgrove (1947, p. 48).

The Rio Fuerte Basketmaker–Cave Dweller sequence postulated by Zingg (1940) is probably related to the prehistoric and historic Tarahumara, but not, as Zingg also suggested, to the San Juan Basketmaker (W. W. Taylor, 1943, p. 310).

A few wooden artifacts reported by Sayles (1936) from northern Chihuahua represent the late period in the Casas Grandes culture (Kidder and Cosgrove, 1949).

Trans-Pecos

Tentative culture sequences for the Trans-Pecos area have been suggested by Sayles (1933), Kelley, Campbell and Lehmer (1940) and Stephenson (1950). Correlation of Texas culture sequences with dunes and alluvial deposits is discussed by Bryan and Toulouse (1943). H. C. Taylor (1949) and Kelley (1950) discuss the Pecos River Focus and the Chisos Focus and the date of the introduction of the bow and arrow into Texas. Sites in the Trans-Pecos that contain wooden artifacts belong to the Pecos River and Chisos Foci of the Big Bend Aspect. V. J. Smith (1932) has discussed possible relationships of the Big Bend Basketmaker to the San Juan (Anasazi) Basketmaker.

Northeast New Mexico, Northwest Oklahoma and the Ozark Bluffs

The Cimarron Caves (Renaud, 1930) are discussed by Bell and Baerreis (1951) as the Kenton Caves, and these two authors indicate that the Kenton Caves are contemporaneous with the latter part of the Grove Focus in Oklahoma. The Grove Focus, in turn, is related to the Ozark Bluff Dweller culture (Bell and Baerreis, 1951, p. 10). The relationship of the cave materials of northwestern Oklahoma and the Ozark Bluff Dweller materials to a postulated "Basketmaker-like" horizon widespread in North America is summarized by Bell and Baerreis (1951, pp. 3–4). Baerreis (1951, pp. 80–82, 96) discusses the possible relationships of the Ozark Bluff Dweller complex to specific Southwestern cultures and concludes that it shows greater resemblance to the Mogollon than to the Basketmaker of the San Juan, but that, in any case, the Ozark material is most closely linked with the Southeast, and that any Southwestern relationships must be with earlier cultures "such as Cochise" rather than directly with the Mogollon.

Good

Great Basin

The Promontory culture is the latest in the caves of the Great Salt Lake area. Steward (1937, pp. 121–122) concludes that there are few, if any, suggestions of connection of the Promontory culture with the Basketmaker and Pueblo cultures or with Lovelock Cave.

The primitive and peripheral Boulder culture existed in the Fremont drainage of Utah during Pueblo II times (Morss, 1931, p. 76).

Gypsum Cave was related, on a typological basis, to the Basketmaker and Pueblo horizons (Harrington, 1933). Radiocarbon dates are available for an earlier occupation, the Sloth Period (Johnson, 1951, Table 1, Samples 221, 222), but the association of the atlatl complex with the dated levels is doubtful (R. F. Heizer, 1951a, p. 24).

The earliest occupation level of Lovelock Cave was classified as belonging to the Basketmaker horizon (Loud and Harrington, 1929) and the late level as being affiliated with the northern Paiute. Radiocarbon dates for the earliest occupation level (Johnson, 1951, Table 1, Samples 276, 277, 278) suggest that the Lovelock Basketmaker was not necessarily derived from the San Juan (R. F. Heizer, 1951a, p. 25).

Leonard Rockshelter has been dated by radiocarbon analysis of wooden artifacts (Johnson, 1951, Table 1, Samples 281, 298). The tentative culture sequence in the Lower Humboldt Valley and the place of Leonard Rockshelter in that sequence have been discussed by R. F. Heizer (1951b, pp. 89–97).

A chronological sequence for the Oregon Cave materials and Anasazi Basketmaker was postulated by Cressman (1942, p. 140) on the basis of stratigraphy and typological comparisons. The radiocarbon dates for the Oregon sites (Johnson, 1951, Table 1, Sample 430) have been discussed by Cressman (1951, p. 308) and R. F. Heizer (1951a, p. 24). The Oregon Cave materials represent a northern Great Basin development that has basic affiliations with Lovelock Cave and Leonard Rockshelter.

While the cultural manifestations in the peripheral areas are only indirectly related to the specific problem of this test of the Mogollon hypothesis, the need for a broader comparative viewpoint and the suggestions of a widespread "Basketmaker-like" culture indicate the importance of including these areas in this study.

The wooden artifacts from Tularosa Cave have been assigned to phases in the Mogollon culture sequence on the basis of their stratigraphic positions in the various square levels, which have been assessed by means of the analysis of associated pottery (see Chapter III). The wooden artifacts from Cordova Cave have been treated in a similar manner except that the phases differ; Pre-Pottery in both caves is equivalent; Plain Ware in Cordova Cave is coeval with Pine Lawn and Georgetown in Tularosa Cave, and the Late Phase in Cordova Cave correlates with the San Francisco-through-Reserve-Tularosa in Tularosa Cave (see Chapter III).

While the Tularosa and Cordova Cave collections of Mogollon perishable materials are the first such collections that are stratigraphically controlled, there are other extant collections of Mogollon-Mimbres perishable artifacts. The materials reported by both Hough and Cosgrove are from the Mogollon area (see Preface). The materials obtained by C. B. Cosgrove from caves of the Upper Gila and Hueco areas of New Mexico and Texas were regarded as representing two districts of a Hueco Basketmaker culture contemporary with and related to San Juan Basketmaker. As Lehmer (1949, pp. 236–237) has pointed out, these two districts may be equated with the Mimbres and Jornada branches of the Mogollon and not with the San Juan. The classification of artifacts in Cosgrove's report is a typological one that is not supported by stratigraphic evidence (Lehmer, 1949, p. 236). However, for convenience of comparison, Cosgrove's areal and temporal divisions will be retained when used in this comparative analysis. This can be justified by the fact that the analysis of the stratigraphically controlled Tularosa and Cordova Cave materials indicates that Cosgrove's typological classifications of artifacts and their implied temporal relationships are, in general, correct.

The stratigraphic sequence in Tularosa and Cordova caves makes possible a comparison of wooden artifacts through almost the entire time span of the Mogollon culture.

Wooden artifacts have been recovered from many sites in the Southwest but there are, unfortunately, several collections of wooden artifacts that have not been described in published form, and many of the published reports contain only inadequate descriptive detail concerning wooden specimens (Morris, 1939, p. 38). There is, however, sufficient published information to indicate the importance of some of the similarities and differences in wooden artifacts from sites in the Southwest and neighboring areas.

Woodworking Methods

Techniques of woodworking that are recognizable from marks remaining on specimens include peeling of bark, breaking, whittling, splitting, sawing, scraping, incising, smoothing and polishing. The cutting and breaking combination, an encircling cut and subsequent fracture of remaining core fibers, and the incising-breaking combination, the cutting of T-shaped grooves and subsequent removal of a tenon, were the woodworking methods used in the manufacture of juniper-berry skewers and atlatl dart foreshafts, respectively.

Presumably woodworking was accomplished through the use of stone tools such as choppers, scrapers, knives, drills, saws, abrading and polishing stones. Striations on atlatl dart foreshafts indicate the use of a shaft straightener or smoother.

Atlatls and Atlatl Equipment

Six fragments of atlatls (Figs. 133–137) were recovered from Tularosa Cave, but only three specimens, all from the Pre-Pottery levels, were well enough preserved to be suitable for detailed comparative purposes.

The two distal end fragments are plano-convex in cross section with flush spurs (female type). In one the end is blunt-pointed and the channel short, while the other has a rectangular outline and a long channel. The proximal end fragment is also plano-convex in cross section and has shallow notches and the remains of a leather finger grip.

No complete atlatl dart mainshafts were recovered, but available fragments permit reconstruction of all details except total length. The mainshaft was a long tapering spear with a deep socket in the large end and a shallow cup in the opposite end. The proximal end of the foreshaft fitted into the deep socket in the mainshaft and was held in place with sinew bindings. The proximal end of the mainshaft fitted the atlatl channel perfectly and the cup diameter was such that it permitted a good non-binding fit with the atlatl spur.

Foreshafts for atlatl darts have a tapering proximal end and are pointed, blunted on the distal end, or slotted for use with stone projectile points.

Atlatl dart bunts are one piece wooden cylinders with central tapered tangs on one end. The tangs are identical with the proximal ends of foreshafts.

Published references to atlatl dart mainshafts and foreshafts indicate their uniformity in size and shape throughout the Southwest. Cosgrove (1947, p. 58) has previously stated that ". . . the darts made in Utah and Northern Arizona are in all major respects the same as those from the Upper Gila of New Mexico and the Hueco of Texas." Some of these similarities extend to specimens from sites in the peripheral areas of Nevada, Oregon, Oklahoma, the Ozarks and Texas. The temporal distribution of these similar artifacts ranges from 7038±250 years ago (the dated foreshafts from the Leonard Rockshelter) to around A.D. 900 (the end of the San Francisco Phase in Tularosa Cave).

Some differences in dart mainshafts and foreshafts appear in variations of material, form, and decoration. The use of reed instead of wood for mainshafts is most frequent in the Basin, and compound mainshafts of cane and wood are reported from Gypsum Cave. Multi-color and spiral painting of mainshafts are other possible Basin characteristics, though spiral decoration is also reported from both the Anasazi and Hueco areas. Other forms of painted decoration, solid color bands, are most frequently reported from Anasazi sites but also occur in the Upper Gila and Hueco areas.

Just as in dart mainshafts and foreshafts, there is a wide distribution of many structural similarities in the atlatls from sites in the Southwest proper. These traits are: Plano-convex cross section; flush spur-channel structure (female type); taper from distal to proximal end; shallow notch and leather loop finger grip; blunt point distal end outline; rectangular proximal end outline; size; use of hardwoods (oak); smoothed or polished surfaces; use of charm stones or weights; lack of painted or incised decoration.

A discussion of Southwestern atlatls is included in a world-wide survey of the distribution of male and female atlatl types (Cressman, Williams, and Krieger, 1940).

Against a background of general similarity, individual atlatls from Southwestern sites vary greatly in several details. The most important variations are: the shape of the distal end; the cross section between distal end and spur; and the shape and length of the channel. There are not enough specimens available to substantiate or define atlatl subtypes, but some clusters of traits may be suggested as possible or potential subtypes:

1. Blunt point distal end outline.
   Plano-convex distal end-spur cross section.
   Narrow channel of varying length.
2. Blunt point distal end outline.
   Medial distal end-spur ridge.
   Short, deep, heart-shaped channel.
3. Blunt point distal end outline.
   Medial distal end-spur ridge.
   Long channel, extending to handle.
4. Rectangular distal end outline.
   Plano-convex distal end-spur cross section.
   Long channel.

With the exception of the heart-shaped channel, which is reported only from Anasazi sites, and a possible absence of the rectangular distal end outline in the Anasazi area, there seems to be no definite cultural association of these potential subtypes.

Some important variations of atlatl form may be mentioned. The Ozark Bluff Dweller atlatls are markedly different from those of the Southwest. While some atlatls from the Trans-Pecos sites are similar in some characteristics, others are strikingly different in form when compared with specimens from Southwestern sites. The atlatls recovered from the Oregon caves, and one possibly related Lovelock Cave specimen (Cressman, 1942, p. 139) are likewise completely different in form and decoration when contrasted with atlatls from the Southwest. This fact, coupled with previously noted variations in material, form and decoration of dart mainshafts, strongly suggests the possibility of a Basin atlatl complex markedly different from that of the Southwest, though a "Basketmaker" type atlatl fragment has been found in an Oregon cave (Cressman, 1942, p. 69).

The atlatl equipment from Anasazi and Mogollon sites in the Southwest hangs together as a complex when contrasted with the variations seen in specimens from the peripheral areas, but there is also evidence of regional specialization within the Southwest. However, some over-all similarities in atlatl equipment are found from Oregon to Texas and from Nevada to the Ozarks and may be interpreted as one manifestation of a general pattern widespread in North America.

Atlatls are reported from the following sites or areas:

Site	*Reference*
Anasazi:	
Broken Roof Cave; Cave 3	Guernsey, 1931, pp. 71–72
Cave 1, Kayenta	Kidder and Guernsey, 1919, p. 178
Canyon del Muerto	Cressman, 1942, Fig. 93, *a*
Grand Gulch area	Pepper, 1902b, pp. 111, 113 Starr, 1898, pp. 233–235 Chicago Natural History Museum cat. nos. 165168, 165169, 92190
Lukachukai	Mason, 1928, pp. 302–310
Mancos Canyon	
San Juan	Pepper, 1902b, p. 118
White Dog Cave	Guernsey and Kidder, 1921, pp. 80–83
Mogollon:	
Hueco area	Cosgrove, 1947, pp. 48, 50
Guadalupe:	
Burnet Cave	Howard, 1935, p. 68
Rock Fall Cave	Mera, 1938, pp. 46, 57
Great Basin:	
Lovelock Cave	Loud and Harrington, 1929, pp. 100, 110
Roaring Springs Cave; Plush Cave	Cressman, Williams and Krieger, 1940; Cressman, 1942, p. 69

Trans-Pecos:	
Baylor Rock Shelter	Fenenga and Wheat, 1939, pp. 221–223
Bee Cave	Coffin, 1932, p. 28
Shelby Brooks Cave	Jackson, 1937, p. 27
Shumla Cave	Martin, G. C., 1933b, pp. 25, 29–30 Gardner and Martin, n.d., pp. 15–18
Northeast New Mexico, Oklahoma and Ozarks:	
Cimarron Cave	Baker and Kidder, 1937, pp. 51–52
Ozark Bluff Dweller	Harrington, 1924, p. 5
Mexico:	
Coyote Burial Cave	Cosgrove, 1947, p. 50

Atlatl dart mainshafts, foreshafts and bunts are reported from the following sites or areas:

Site	*Reference*
Anasazi:	
Broken Roof Cave	Guernsey, 1931, Pl. 48
Cave 1, northeastern Arizona	Kidder and Guernsey, 1919, pp. 181–182
Cottonwood Canyon	Judd, 1926, p. 147
Du Pont Cave	Nusbaum, Kidder and Guernsey, 1922, pp. 107–113
Grand Gulch	Pepper, 1902b, pp. 119–129
Jemez Cave	Alexander and Reiter, 1935, p. 48
White Dog Cave	Guernsey, 1931, pp. 83–87
Mogollon:	
Caves of the Upper Gila and Hueco areas	Cosgrove, 1947, pp. 50–58
Sandal Cave	Harrington, 1928, p. 10
Tularosa Cave	Hough, 1914, Figs. 136, 138
Guadalupe:	
Burnet Cave	Howard, 1935, p. 70
Cave in Last Chance Canyon	Howard, 1930, p. 197
Goat Cave	Mera, 1938, p. 57
Hermit's Cave	Ferdon, 1946, p. 19
Great Basin:	
Gypsum Cave	Harrington, 1933, pp. 89–120
Lovelock Cave	Loud and Harrington, 1929, p. 98
Leonard Rockshelter	Heizer, 1938, p. 70; 1951b, p. 92
Oregon	Cressman, Williams and Krieger, 1940; Cressman, 1942, p. 70
Trans-Pecos:	
Bee Cave	Coffin, 1932, pp. 27, 30–31
Fate Bell Shelter	Pearce and Jackson, 1933, pp. 121–122
Shumla Cave	Martin, G. C., 1933b, p. 27
Northeast New Mexico, Oklahoma and the Ozarks:	
Cimarron caves	Baker and Kidder, 1937, p. 52 Renaud, 1930, p. 146
Ozark Bluff Dweller	Harrington, 1924, p. 5

Bows

Bow fragments (Fig. 138) from Tularosa and Cordova caves can be described as Type 2 in Cosgrove's terminology (1947, p. 61).

There is little descriptive data concerning bows from the sites in the Southwest and peripheral areas and the few reported specimens seem quite similar, though sinew backing may be more prevalent in the Great Basin.

Bows are reported from the following sites:

Site	*Reference*
Anasazi:	
Aztec Ruin	Morris, 1919, p. 60
Betatakin	Judd, 1931, p. 58
Canyon Creek Ruin	Haury, 1934, p. 106
Cave 1, Segi; Poncho Burial; Turkey Cave	Guernsey, 1931, pp. 99, 107
Chevlon	Fewkes, 1904, p. 100
Rio Colorado area	Judd, 1926, p. 148
Mogollon:	
Upper Gila area	Cosgrove, 1947, p. 61 Hough, 1907, p. 24
Great Basin:	
Gypsum Cave	Harrington, 1933, p. 127
Lovelock Cave	Loud and Harrington, 1929, p. 97
Promontory Cave 1	Steward, 1937, p. 17
Roaring Springs Cave	Cressman, 1942, p. 70
Mexico:	
Rio Fuerte	Zingg, 1940, p. 58

Arrows

Arrows (Figs. 138–140) recovered from Tularosa and Cordova caves are compound, consisting of a reed mainshaft and a wooden foreshaft. The details of construction and size as compared with arrows from other sites in the Southwest confirm the classification of these specimens as utilitarian arrows intended for use as weapons.

Mainshaft: A wooden plug inserted in the proximal end of the reed mainshaft serves as a reinforcement for the nock that is cut into both cane and wood. Nocks range from V to U shapes and, when the nock plug is not present, are cut in the reed above a node which serves the same purpose as the plug. Sinew bindings at the nock and distal ends are used to hold the nock plug and foreshaft in place and to prevent splitting. Three trimmed feathers are attached to the shaft with sinew bindings, and painted decoration is confined to the area under the feathers or around the nock. Decorations consist of painted bands of black and/or red, but most mainshafts are not decorated.

Foreshaft: The foreshaft tapers from the distal point to a larger diameter near the proximal end where the tang is formed by either a reverse taper or a shoulder and central tang. Most foreshafts are plain pointed, or have re-sharpened points, and only two Tularosa Cave specimens are slotted for use with stone projectile points. While most foreshafts are not decorated, some have an all-over red stain, leaving only the distal tip and the proximal tang unpainted.

The few archaeological examples of solid wood shafted simple arrows are associated with late sites or with historic tribes in the Southwest.

The most striking variation of the general pattern is in the arrows reported by Cosgrove (1947, p. 65) from the caves of the Upper Gila area in New Mexico. The complex geometric painted designs on both arrow mainshafts and foreshafts are a distinguishing characteristic of the Mimbres area. One specimen from Tularosa Cave has similar elaboration of decorative pattern. Cosgrove contends that many of these arrows were used ceremonially as well as for hunting.

Painted decoration of arrow mainshafts is frequently reported from Anasazi sites, but the patterns are simple bands.

The origin of the bow and arrow in the Southwest is still an unsolved problem. Some of the earliest known arrow foreshafts are from a Basketmaker II site in Canyon del Muerto where the occupants were killed by people using bows and arrows (Morris, 1939, p. 19). For at least one Modified Basketmaker site, Obelisk Cave, the suggestion has been made that the bow and arrow had completely superseded the atlatl before A.D. 700 (Morris, 1936, p. 36). The seriation of wooden artifacts from Tularosa Cave indicates that the Mogollon made increasing use of the bow and arrow after A.D. 700, during the San Francisco Phase, and supports the hypothesis of a slightly earlier acceptance, if not development, of the bow and arrow in the northern part of the Southwest. However, bow and arrow fragments from Ventana Cave came from levels 1 to 3 in both the upper and lower caves, and Haury concludes that the weapon came in with pottery and agriculture at the time of the shift from San Pedro to Hohokam, or about A.D. 1 (Haury, 1950, p. 420). The Pine Lawn and Pre-Pottery arrow fragments from Tularosa Cave, though few in number, when combined with this evidence from Ventana Cave, afford some support for a southern development or source for this weapon.

The introduction of the bow and arrow in the Trans-Pecos area has been discussed by H. C. Taylor (1949) and Kelley (1950, p. 71), who concludes: "... the bow and arrow may have become familiar to the people of the Chisos focus as early as circa A.D. 900, one guess date for the appearance of the Livermore focus in the Big Bend." This suggestion supports the theory of a continuing southward diffusion of the bow and arrow.

While origins remain obscure, the widespread structural similarity of the compound arrow in the Southwest and peripheral areas suggests the broad relationships of the bow and arrow complex, which replaced the preceding atlatl complex. Within the Southwest, the Mogollon-Mimbres of the Upper Gila area exhibits a local variation of elaborate decoration of arrows.

Arrow mainshafts and foreshafts are reported from the following sites or areas:

Site	*Reference*
Anasazi:	
Aztec Ruin	Morris, 1919, pp. 59–60
Betatakin	Judd, 1931, p. 58
Canyon Creek	Haury, 1934, pp. 106–107
Jemez Cave	Alexander and Reiter, 1935, p. 47
Johnson Canyon	Morris, 1911, p. 178
Kayenta	Guernsey, 1931, p. 107 Kidder and Guernsey, 1919, pp. 122–123
Medicine Cave	Bartlett, 1934, pp. 37–38
Pecos Pueblo	Kidder, 1932, pp. 290–291
Pueblo Bonito	Pepper, 1920, pp. 31, 36–37, 109, 159
Ruin No. 9, Mesa Verde	Nordenskiold, 1893, p. 101
Spruce Tree House	Fewkes, 1909, p. 44
Hohokam:	
Double Butte Cave	Haury, 1945a, pp. 200–201
Ventana Cave	Haury, 1950, pp. 418–419
Mogollon:	
Caves of Upper Gila	Hough, 1914, pp. 63–64
Caves of Upper Gila and Hueco areas	Cosgrove, 1947, pp. 62–65
Winchester Cave	Fulton, 1941, pp. 16, 18–19
Guadalupe:	
Cave 70 miles north of El Paso	Gould, 1929, p. 157
Goat Cave	Mera, 1938, p. 58
Hermit's Cave	Ferdon, 1946, p. 19
Great Basin:	
Fremont, Sites 7, 11, 13	Morss, 1931, p. 61
Gypsum Cave	Harrington, 1933, pp. 120–127
Lovelock Cave	Loud and Harrington, 1929, p. 97
Promontory Cave 1	Steward, 1937, p. 11
29 Palms	Campbell, 1931, p. 74
Trans-Pecos:	
Bee Cave	Coffin, 1932, pp. 31–32
Caldwell Cave	Jackson, 1937, p. 162
Carved Rock Shelter	Smith, 1938, p. 227
Fate Bell Shelter	Pearce and Jackson, 1933, pp. 123–125
Knight Ranch Cave	Setzler, 1935, p. 108
Shumla Cave	Martin, G. C., 1933b, pp. 26–27

Mexico:	
Chihuahua	Sayles, 1936, p. 80
Rio Fuerte	Zingg, 1940, pp. 50, 60

Digging Sticks

Fragments of digging sticks (Figs. 141, 142) recovered from the caves include both flat-bladed and plain-pointed specimens with shafts of varying diameter. One of the flat blades from Tularosa Cave is carefully worked, but the other has merely the natural form of the wood. Handles are plain, the ends of the shafts being unmodified except for smoothing.

Both flat-bladed and plain-pointed digging sticks are widely distributed in the Southwest. Flat blades and sword-shaped blades are reported from Pueblo III sites, though plain-pointed specimens are also frequent in the Anasazi area. Crook and knob handles may be more frequent in Anasazi specimens. No flat-bladed digging sticks are reported from the Trans-Pecos area, but they were found in both Gypsum and Lovelock caves in the Basin.

There is widespread similarity in digging sticks throughout the Southwest and peripheral areas, but the sword-shaped blade and knob handle represent Anasazi specializations.

Digging sticks are reported from the following sites or areas:

Site	*Reference*
Anasazi:	
Aztec Ruin	Morris, 1919, p. 46
Betatakin	Judd, 1931, p. 56, Pl. 34
Canyon Creek Ruin	Haury, 1934, p. 104
Cliff Palace	Fewkes, 1911, p. 73
Cottonwood Canyon	Judd, 1926, Pl. 55
Du Pont Cave	Nusbaum, Kidder and Guernsey, 1922, pp. 113–115
Jemez Cave	Alexander and Reiter, 1935, p. 42
Johnson Canyon	Morris, 1911, pp. 177–178
Mesa Verde	Nordenskiold, 1893, p. 100
NA. 862; NA. 1625c	Bartlett, 1934, pp. 36–37
Northeastern Arizona	Kidder and Guernsey, 1919, pp. 119–120
Painted Cave	Haury, 1945b, p. 50
Pecos Pueblo	Kidder, 1932, p. 290
Spruce Tree House	Fewkes, 1909, p. 44
White Dog Cave; Cave 7	Guernsey and Kidder, 1921, pp. 89–90
Hohokam:	
Casa Grande	Fewkes, 1912, p. 146, Pl. 76
Ventana Cave	Haury, 1950, p. 415
Mogollon:	
Caves of Upper Gila	Hough, 1914, p. 62, Pl. 13
Caves of Upper Gila and Hueco areas	Cosgrove, 1947, pp. 148–149
Winchester Cave	Fulton, 1941, p. 33

Guadalupe:	
Hermit's Cave	Ferdon, 1946, p. 19
Great Basin:	
Fremont sites	Morss, 1931, p. 61
Gypsum Cave	Harrington, 1933, p. 140
Lovelock Cave	Loud and Harrington, 1929, pp. 95–96
Promontory Cave 1	Steward, 1937, p. 20
29 Palms Region	Campbell, 1931, pp. 76–77
Roaring Springs Cave	Cressman, 1942, Table 18, p. 71
Trans-Pecos:	
Bee Cave	Coffin, 1932, p. 30
Fate Bell Shelter	Pearce and Jackson, 1933, p. 128
Shumla Caves	Martin, G. C., 1933b, p. 68

Bark and Wooden Trowels

Bark trowels made of roughly rectangular segments of pine (*Pinus ponderosa*) bark, rectangular wooden trowels and wooden scoops (Figs. 142, left; 143) were recovered from the pre-A.D. 700 levels in Tularosa and Cordova caves.

Wooden and bark trowels are reported from various sites in the Southwest. These artifacts are characteristic of the Anasazi Basketmaker and the Pecos River Focus and are present in both Upper Gila and Hueco area sites. Trowels represent a widespread trait that is identical in the Anasazi, Mogollon, and Pecos River focus cultures, but the Pre-Pottery occurrence in Tularosa Cave is the earliest yet reported.

Bark and wooden trowels are reported from the following sites or areas:

Site	*Reference*
Anasazi:	
Du Pont Cave	Nusbaum, Kidder and Guernsey, 1922, pp. 115–117
Northeastern Arizona	Kidder and Guernsey, 1919, p. 187, Fig. 91 Guernsey, 1931, pp. 108, 183–184
Painted Cave	Haury, 1945b, p. 51
White Dog Cave	Guernsey and Kidder, 1921, pp. 90–91
Mogollon:	
Blue River Cave	Hough, 1914, p. 63
Upper Gila and Hueco areas	Cosgrove, 1947, pp. 145–146
Great Basin:	
Fremont, Site 27	Morss, 1931, p. 63
Trans-Pecos:	
Fate Bell Shelter	Pearce and Jackson, 1933, p. 121
Murrah Cave	Holden, 1937, p. 66
Shelby Brooks Cave	Jackson, 1937, pp. 161–162
Shumla Caves	Martin, G. C., 1933b, p. 67

Wooden Knife Handles

Wooden knife handles (Fig. 146, *c*) from Cordova Cave are cylindrical in cross section and have a slot in one end. Sinew binding marks encircle the handle below the slot.

These specimens may be compared with knife handles from Winchester Cave, Tularosa Cave, Cave 6 in northeastern Arizona and Sites 11 and 13 in the Fremont area. They may be contrasted with flat (rectangular or oval in cross section) knife handles reported from Aztec Ruin, White Dog Cave, and the Grand Gulch.

Site	*Reference*
Anasazi:	
Aztec Ruin	Morris, 1919, p. 33
Cave 6	Guernsey and Kidder, 1921, p. 87, Pl. 35
White Dog Cave	
Grand Gulch	Chicago Natural History Museum, cat. nos. 21451, 21452, 21453
Mogollon:	
Tularosa Cave	Hough, 1914, p. 62
Winchester Cave	Fulton, 1941, p. 34
Great Basin:	
Fremont, Sites 11, 13	Morss, 1931, p. 62

Fire Drill Hearths

Two types of fire drill hearths (Fig. 144) were recovered from Tularosa Cave. These are the plano-convex hearth, made of split sticks with the drill socket set in the flat side, and the cylindrical hearth, round in cross section and having several drill sockets set in a row on one side of the stick. The drill sockets all have a slot in one side of the stick. A shift from plano-convex to cylindrical fire drill hearths occurs in the San Francisco Phase in Tularosa Cave. A flat hearth was recovered from the Pre-Pottery levels of Cordova Cave, but all other hearths are cylindrical in cross section.

Comparisons with fire drill hearths from other sites are incomplete, since cross sections are often not recorded.

Haury states that "Anasazi hearths appear to have been in round sticks as a rule." (Haury, 1950, p. 420.) The adoption of cylindrical hearths in the Mogollon area may, therefore, have been the result of Anasazi influences during the San Francisco Phase, but the lack of agreement between the Tularosa and Cordova Cave collections does not confirm the shift in hearth types suggested above.

Hearths from the peripheral areas are similar in having slotted sockets, though some specimens from the Trans-Pecos have grooves or holes in the bottom of the sockets.

Fire drills are reported from many sites but they have few distinguishing characteristics other than the difference between simple and compound drills. Only three Tularosa Cave specimens were identified as fire drills, one of which was the foreshaft of a compound fire drill.

Fire drill hearths are reported from the following sites or areas:

Site	*Reference*
Anasazi:	
Aztec Ruin	Morris, 1919, p. 46
Betatakin	Judd, 1931, p. 58, Pl. 35
Canyon Creek	Haury, 1934, p. 104
Cottonwood Canyon	Judd, 1926, Pl. 52
Cliff Palace	Fewkes, 1911, p. 74
Johnson Canyon	Morris, 1911, p. 178
Kayenta	Kidder and Guernsey, 1919, pp. 120–121
Painted Cave	Haury, 1945b, p. 51
Spruce Tree House	Fewkes, 1909, p. 44
Hohokam:	
Ventana Cave	Haury, 1950, pp. 414–415
Mogollon:	
Caves of Upper Gila and Hueco areas	Cosgrove, 1947, pp. 146–148
Winchester Cave	Fulton, 1941, p. 33
Guadalupe:	
Hermit's Cave	Ferdon, 1946, p. 20
Great Basin:	
Fremont	Morss, 1931, p. 62
Lovelock Cave	Loud and Harrington, 1929, pp. 96–97
Promontory Cave 1	Steward, 1937, p. 74
29 Palms	Campbell, 1931, p. 77
Trans-Pecos:	
Bee Cave	Coffin, 1932, pp. 27–28
Fate Bell Shelter	Pearce and Jackson, 1933, pp. 127–128
Hord Rock Shelter	Smith, 1934, p. 99
Murrah Cave	Holden, 1937, p. 69
Shelby Brooks Cave	Jackson, 1937, pp. 27–28
Shumla Cave	Martin, G. C., 1933b, p. 65

Burred Pieces (Feather Carders?)

These problematical artifacts (Fig. 149, *g*, *h*) are sections of sticks or branches with one end shredded to form a mass of wood fiber. They occur in both caves, but most are from Tularosa. All but one specimen have bits of feather down or small feathers caught in the burred portion of the artifact.

Similar artifacts, also from Tularosa Cave, are reported by Hough, who suggests that they were pounded stakes or sticks shaved to obtain thin spindles. They are also reported from Winchester Cave, Kelley Cave, and Ventana Cave.

The presence of feather material in the burred portions suggests their use as feather-carding devices, possibly related to the manufacture of feather cord (Chapter VI).

Burred pieces or feather carders(?) are reported from the following sites:

Site	*Reference*
Hohokam:	
Ventana Cave	Haury, 1950, pp. 417–418, Pl. 35
Mogollon:	
Kelley Cave	Cosgrove, 1947, Fig. 137, *j*
Tularosa Cave	Hough, 1914, p. 60
Winchester Cave	Fulton, 1941, p. 34

Hinged-Stick Snares

Hinged-stick snares (Fig. 146, *g*) are described from the Sawmill Shelter in Nevada, and similar fragments are reported from northeastern Arizona and the Upper Gila area.

Hinged-stick snares are reported from the following sites or areas:

Site	*Reference*
Anasazi:	
Northeastern Arizona	Kidder and Guernsey, 1919, p. 187
Mogollon:	
Upper Gila area	Cosgrove, 1947, p. 136
Great Basin:	
Sawmill Shelter	Schellbach, 1927, pp. 232–240

Spindles

Long, thin spindles (Fig. 147, *b*, *c*), with diameters matching those of holes in the spindle whorls, were recovered from both caves. Spindles are reported from Canyon Creek Ruin, Betatakin, and northeastern Arizona.

Site	*Reference*
Anasazi:	
Betatakin	Judd, 1931, pp. 60–61
Canyon Creek	Haury, 1934, p. 110
Northeastern Arizona	Guernsey, 1931, pp. 82–83

Ceremonial and Miniature Bows and Arrows

For the purposes of this section, *ceremonial bows* (Fig. 147, *e*, *f*) will be defined as bows of more than 35 and less than 87 cm. in length and of such delicate nature that they probably could not have been used for warfare or hunting.

Miniature bows (Fig. 152) are defined as bows of less than 35 cm. in length and are so slender and so small that they are often referred to as "toy bows." Obviously, these bows could not have been used in hunting or warfare, and thus in a broad sense they too are really "ceremonial" in nature.

All these ceremonial bows are self-bows and are simple wooden staves with curved limbs. They bear no reinforcements of sinew, rawhide, or any other material. The ceremonial bows would probably have pulled not more than five pounds. (Modern bows pull as much as seventy pounds and as little as thirty; Pope, 1923, p. 335.)

Some of the ceremonial bows are painted red except in the handgrip; others are painted red and decorated with black parallel bands or rings; and one is decorated with a design (rendered in black) similar to that which is found on Reserve Black-on-White pottery. Hough reported finding a similar one in Bear Creek Cave, on the Blue River, a tributary of the San Francisco.

The bows from Tularosa Cave are all fragile and short. The only complete one is 85 cm. long and 9 cm. in diameter. Another, nearly complete, is 86 cm. long and 14 cm. in diameter.

In the bows found by Cosgrove in the Upper Gila area, the measurements range in length from 94 cm. to 1.37 meters; and in diameter, from 19 to 37 cm.

A few prehistoric Anasazi bows have been recovered from caves. In Cave 1, Segi Canyon, Guernsey found a Pueblo I bow that was 5 feet long and 1⅛ inches thick at the grip. He mentions two Pueblo III bows, one from Segi Canyon and the other from Poncho House. These latter bows measure 4 feet 6½ inches long and 3 feet 10 inches long, respectively (Guernsey, 1931, pp. 99, 107).

The bows used in historic times for hunting and warfare are much stouter than those from Tularosa Cave; for example, a modern Tarahumare bow is slightly more than 1 meter in length; a Pima bow, 1.37 meters; and a Navajo bow, 1.2 meters.

It seems probable, then, that the largest bows from Tularosa Cave are too short and thin to have been used for hunting or warfare. They may have been used in games, or possibly for shooting birds, or in ceremonies.

Certainly the miniature bows (about 30 cm. in length or less) were not intended to be utilitarian. Among the Hopi Indians, miniature bows were tied to a warrior's bandoleer, hung on the eagle's perch in the Niman katchina ceremony, "sacrificed" along with the eagles on the tenth day of the Niman ceremony, and given to little boys on the ninth day of that ceremony (Hopi Journal, by A. M. Stephen, E. C. Parsons, Editor, Columbia University Press, New York, 1936, pp. 98, 540, 568, 569).

In addition to the miniature bows mentioned by Hough and Cosgrove and those found by us in Tularosa Cave, two were found by Haury in the Canyon Creek Ruin. Haury felt at that time that these were utilitarian and not toys, and suggested that they may have been used in fire-making or drilling. Certainly, a few of the miniature bows may have been used for such purposes, but many shown by Hough are decorated with feathers and cigarettes. Some of Cosgrove's specimens and two of ours consisted of bow-sets and were too delicate for any use whatsoever. It seems most probable that our smaller bows, at least, were used as pahos, as presents for boys, in the bow-cult (if it existed) or in some ceremonial fashion.

The arrows described in this section were far too delicate to have been serviceable in warfare. They might have been used for shooting birds, in games, or in ceremonies.

By far the majority of the reported miniature bows and arrows and ceremonial bows and arrows are from the Upper Gila area. Only a few specimens are reported from Anasazi sites and only one from the Trans-Pecos area.

The seriation of wooden artifacts from Tularosa Cave indicates that the ceremonial and miniature bows and arrows were adopted during the San Francisco Phase along with the hunting bow and arrow. While there is some evidence of an earlier occurrence of the hunting bow and arrow in Anasazi sites, the ceremonial and miniature bows are not reported in the north until Pueblo III, a time later than the occurrence in Tularosa Cave. At present, the published evidence suggests that these artifacts represent a Mogollon development.

Ceremonial and miniature bows and arrows are reported from the following sites:

Site	*Reference*
Zuni War God Shrines	Parsons, 1918, Pl. III
Anasazi:	
Canyon Creek Ruin	Haury, 1934, pp. 106–108
Pecos Pueblo	Kidder, 1932, p. 294
Segi Canyon	Guernsey, 1931, p. 99

Mogollon:

Bear Creek Cave	Hough, 1914, pp. 99–100
Upper Gila area	Cosgrove, 1947, pp. 130–131
Winchester Cave	Fulton, 1941, pp. 19–20

Trans-Pecos:

Bee Cave	Coffin, 1932, p. 28
Shumla Cave	Martin, G. C., 1933b, pp. 68–69

Juniper-Berry Skewers

Nine descriptive categories were used to list the variations distinguishable in Juniper-berry skewers (Fig. 153), but all specimens exhibit the same general characteristics of form and size.

These skewers consist of a body and a shaft carved from a single twig; the tapering pointed shaft protrudes from one end of the cylindrical body and is nearer to the rim than to the center. The body diameter is that of the original twig while the shaft is of greatly reduced diameter. In a complete specimen, the shaft is always about twice as long as the body. Breaking, cutting, scraping and carving marks appear on the ends of the body and on the bark-free shaft. The bark is usually removed from the body but occasionally remains, either in whole or in part. Only a few specimens show possible decorative bark patterns. Juniper berries were found impaled on the shafts of some specimens, the number of berries a particular skewer would hold being dependent upon shaft length and berry diameter. None of the variations noted in the nine descriptive categories is associated with any particular phase of the cave occupation.

Three unfinished specimens give evidence of the process of manufacture of these artifacts. A hardwood twig of small diameter was used, and the bark was either removed or left in place during manufacture. The shaft was carved first, and the body was formed by cutting an encircling groove around the twig the proper distance below the base of the shaft. The completed artifact was broken away from the unused portion of the twig at the point where the groove was cut. Sometimes the ends of the body were smoothed. It seems probable that most of the variations noted in the descriptive categories were merely the result of the accidents of manufacture or thoroughness of workmanship applied to the particular artifact.

A broken specimen was repaired by binding the two halves of its split body together with sinew. This evidence of repair probably indicates that these artifacts were either difficult to make or were of sufficient importance to warrant repair rather than discard.

Juniper-berry skewers were present in both Tularosa and Cordova caves. The seriation of wooden artifacts from Tularosa Cave indicates that the highest frequency of these artifacts was during the Pine Lawn and Georgetown phases with a sharp decline in the following San Francisco Phase.

The only other occurrences of these artifacts are in Steamboat Cave, and Site 1, Sapillo Creek, in the Upper Gila area of New Mexico (Cosgrove, 1947, p. 150) where berry-less "wooden pins" are reported from the "Basketmaker" occupation. The hardwood pegs reported from the Promontory caves in Utah by Steward (1937, p. 23) have the same general dimensions and proportions but differ in form. The Promontory peg shaft is formed by splitting the twig lengthwise and does not resemble the thin cylindrical shaft typical of the Juniper-berry skewer.

Although further distributional evidence is required, the Juniper-berry skewer may be regarded as a trait distinguishing the Mogollon from other Southwestern cultures.

Reed Cigarettes

Four types of reed cigarettes (Fig. 154) are present in the Tularosa Cave collection. All types have the following common characteristics: they are made of *Phragmites communis;* the ends are cut squarely at right angles to the long axis; and they include one node, the septum of which is pierced.

Cigarettes that have a cotton yarn binding around a centrally located node make up one type. Neither end of any of these cigarettes is charred and it is probable that they were never smoked, especially since the distance between the node and the end of the artifact indicates that the charred butts discussed below could not have been produced by burning any of the specimens with central nodes.

Butts are sections of reed with one charred end. As the node is located in the center of the butt fragment, it must have been nearer one end of the original unburned specimen.

Cigarettes with the node near one end were also recovered from the cave. When burned, these specimens could produce the butt fragments described above.

Reed cigarettes with elaborate decorations consisting of bundles of corn husks, feathers, seeds, and cotton yarn occur only in the San Francisco-through-Tularosa mixed levels.

The reed cigarettes from Tularosa Cave are filled with short sections of wild tobacco stems and represent the earliest recorded use of this plant material.

A comparison of published descriptions of reed cigarettes from sites in the Southwest shows that several characteristics are widely distributed. Such traits are:

Use of reed, probably *Phragmites communis.*
Ends cut squarely at right angles to long axis.
Node near one end of cigarette.
Septum pierced.
One end charred.
Aromatic bark contents in charred end.
Diameter between ¼ and ½ inch.
Length between 3 and 6 inches.

Variations that are also widely distributed and frequently reported are:

Node in center.
Unburned and probably not intended for smoking.
Unpierced septum.

The decorations used on reed cigarettes show significant distributions.

While the reed cigarettes from the Hohokam area in Arizona have a variety of cotton wrappings, the most distinctive traits are the practice of making bundles of three or four cigarettes and the use of woven cotton sashes as bindings around nodes. Discussing these traits as represented in Double Butte Cave, Haury says:

> The cane cigarettes with cotton sashes are pretty closely confined to caves of the Gila Basin and may therefore be Hohokam, while cigarettes without this feature are widely used among the Pueblos. The effigy pahos of Double Butte Cave manifest a strong Pueblo character and no analogies with recent Pima articles. It seems probable that much of the Double Butte material can be attributed to the Pueblos during their occupation of this area in late prehistoric times (Haury, 1945a, p. 193).

McGregor attributes these artifacts to the Salado Branch (McGregor, 1941b, p. 337) and Hough reports both the woven cotton sash and bundles of cigarettes from the Upper Gila area (Hough, 1914, p. 107).

Plain reed cigarettes have been reported from only a few Pueblo II and III sites, though Haury implies a much more widespread distribution of these artifacts among the Anasazi.

Reed cigarettes from the Upper Gila area have been described by Hough and Cosgrove. The latter author has reported many decorative variations, including the use of cotton yarn, dyed cotton yarn, attachment of small beads, painting in several colors and the attachment of reed cigarettes to miniature bows. Chronological placement of the cigarettes reported by Cosgrove is uncertain. The specimens from Greenwood Cave, Mule Creek Cave and Cave 3, Deer Creek, are all listed as Pueblo artifacts, while cigarettes reported from other caves in the area are listed as "either Basket Maker or Pueblo."

> In listing artifacts, reed cigarettes have been classified as Puebloan, yet their presence in caves of the Upper Gila and Hueco areas, where both Basket-Maker and Pueblo cultures are represented, is confusing, especially when a number came from Ceremonial Cave, a predominantly Basket-maker site. As a symbolic offering they may have been of ancient origin, but from their common occurrence, at times in great profusion in Pueblo ruins, reed cigarettes seem to belong to the later period (Cosgrove, 1947, p. 122).

In Tularosa Cave reed cigarettes are present in the Georgetown Phase and possibly as early as Pine Lawn. As the seriation (Fig. 130) shows, these artifacts increase in popularity in the later occupation of the cave. Both the early occurrence and the late development seem to confirm Cosgrove's suggestion. Reed cigarettes reported from Anasazi, Hohokam, and Salado sites are temporally later than those from sites in the Mogollon area. The specimens from the Trans-Pecos are also later than the Tularosa Cave cigarettes. There is, therefore, some evidence of an earlier Mogollon use of reed cigarettes, coupled with a later spread of the artifact to other Southwestern cultures. Lack of decoration or specialized forms of decoration are contrasting characteristics of the reed cigarettes from the Anasazi, Hohokam or Salado, and Mogollon in late prehistoric times.

Reed cigarettes are reported from the following sites or areas:

Site	*Reference*
Anasazi:	
Aztec Ruin	Morris, 1919, pp. 57–58
Canyon Creek	Haury, 1934, p. 114
Medicine Cave	Bartlett, 1934, pp. 38–39
Painted Cave	Haury, 1945b, p. 53
Hohokam:	
Casa Grande	Fewkes, 1912, p. 135
Cave near Phoenix	Hough, 1914, p. 107 Chicago Natural History Museum cat. nos. 16372, 16373
Double Butte Cave	Haury, 1945a, pp. 194–196
Ventana Cave	Haury, 1950, p. 426

Mogollon:	
Bear Creek Cave; Tularosa Cave	Hough, 1914, p. 107
Caves of Upper Gila and Hueco areas	Cosgrove, 1947, pp. 121–122
Winchester Cave	Fulton, 1941, pp. 20–21
Great Basin:	
Gypsum Cave	Harrington, 1933, p. 148
Trans-Pecos:	
Bee Cave	Coffin, 1932, p. 32
Fate Bell Shelter	Pearce and Jackson, 1933, pp. 128–129
Moore's Rock Shelter	Quinn and Holden, 1949, p. 130
Shelby Brooks Cave	Jackson, 1937, p. 162
Shumla Cave	Martin, G. C., 1933b, p. 65, Pl. 37
Mexico:	
D:12:5 Chihuahua	Sayles, 1936, p. 78

Tablitas

Rectangular wooden tablitas (Figs. 155, 156) with diamond-shaped designs painted in black, green, and red were recovered from the Late occupation levels of Cordova Cave.

Cosgrove reports many tablitas from the Upper Gila and Hueco areas, but none with similar shapes or decorations. These artifacts seem to be characteristic of the late occupation of the Upper Gila (Cosgrove, 1947, p. 134) as none are reported from other areas.

Painted Sticks

Painted sticks (Fig. 157, *h–k*) were characteristic of the post-Georgetown occupations of Tularosa and Cordova caves. Decorations of these small twigs consisted of bands of black, green, and/or red.

Similar artifacts are reported from the caves of the Upper Gila area and from Betatakin and Shumapovi in the Anasazi area.

Painted sticks are a part of the ceremonial complex introduced into the Mogollon area during or after the San Francisco Phase.

Site	*Reference*
Anasazi:	
Betatakin	Judd, 1931, p. 61
Shumapovi	Fewkes, 1904, p. 99
Mogollon:	
Caves of Upper Gila area	Hough, 1914, pp. 129–132 Cosgrove, 1947, p. 124

Carved Pahos

Carved pahos (Fig. 146, *i*) are reported from various sites in the Southwest. They occur in quantity in the Upper Gila area caves reported by Cosgrove, although only one fragment of such a paho was recovered from Cordova Cave. The wide distribution of carved pahos is probably a manifestation of the influences diffusing from the Anasazi culture in Pueblo III times.

Carved pahos are reported from the following sites or areas:

Site	*Reference*
War God Shrines, Laguna and Zuni	Parsons, 1918, pp. 381–405
Anasazi:	
Betatakin	Judd, 1931, p. 59
Johnson Canyon; Cliff Ruins	Morris, 1911, p. 178
Kayenta, Cliff Dweller	Kidder and Guernsey, 1919, p. 144
Little Colorado Cliff Dwellings	Fewkes, 1904, pp. 99–100
Mesa Verde Cliff Dwellings	Nordenskiold, 1893, p. 100
Pecos Pueblo	Kidder, 1932, p. 293
Pueblo Bonito	Pepper, 1920, pp. 86, 109, 161, 188
White Dog Cave	Guernsey and Kidder, 1921, p. 101
Hohokam:	
Double Butte Cave	Haury, 1945a, pp. 196–200
Ventana Cave	Haury, 1950, p. 424
Mogollon:	
Caves of Upper Gila area	Cosgrove, 1947, pp. 127–128 Hough, 1914, p. 92

Wooden Dice

Wooden dice (Fig. 157, *a–g*) from Tularosa and Cordova caves are rectangular, plano-convex sections of sticks. Decorations or markings, when present, vary with each specimen, but are usually on the flat side. Two exceptions include a specimen with a longitudinal strip of bark removed from the convex side and one with transverse burned lines on the convex side and dark paint on the flat side.

Comparison of these dice with those from other sites shows that nearly all specimens exhibit individual variations.

The Pre-Pottery occurrence of wooden dice in Tularosa Cave is the earliest thus far reported for such artifacts.

Wooden and cane dice are reported from the following sites or areas:

Site	*Reference*
Anasazi:	
Aztec Ruin	Morris, 1919, p. 45
Kayenta area	Kidder and Guernsey, 1919, p. 186
Pueblo Bonito	Pepper, 1920, pp. 36, 108
Mogollon:	
Tularosa Cave	Hough, 1914, p. 61

Great Basin:	
Fremont area	Morss, 1931, p. 63
Gypsum Cave	Harrington, 1933, pp. 147–148
Promontory Cave 1	Steward, 1937, p. 23

Corn Cobs Mounted on Sticks

Corn cobs impaled through the butt end on rough sticks were recovered from Tularosa Cave (Fig. 158, *a–d*). Tooth marks on some of the cobs indicate that these artifacts may have been roasting spits for corn. However, this interpretation does not explain variations such as carefully smoothed sticks or the mounting of two cobs butt to butt on one stick, reported from other sites, and uses as gaming darts or ceremonial objects must not be ruled out.

The artifacts are apparently more common in Pueblo sites than is indicated by the published reports (Cutler, in letter).

The Pine Lawn Phase occurrence of these artifacts is the earliest thus far reported. None are described from Basketmaker sites, though they are present in the Cimarron caves. The corn cob mounted on a stick may, therefore, be a distinguishing early Mogollon trait that later diffused to other areas.

Corn cobs mounted on sticks are reported from the following sites:

Site	*Reference*
Anasazi:	
Aztec Ruin	Morris, 1919, p. 60
Canyon Creek	Haury, 1934, p. 114
Cliff Palace	Fewkes, 1911, Pl. 33
Painted Cave	Haury, 1945b, p. 54
Ruin 3, Kayenta	Kidder and Guernsey, 1919, p. 98
Mogollon:	
Caves of Upper Gila and Hueco areas	Cosgrove, 1947, pp. 12, 36, 38, 65
Northeastern New Mexico and northwestern Oklahoma:	
Cimarron Cave 7	Renaud, 1930, p. 144

Feathers Mounted on Sticks

Short sticks, to which feathers are bound with sinew wrappings (Fig. 159), are probably pahos and occur most frequently in the pre-San Francisco phases at Tularosa Cave. Similar specimens are reported from the Upper Gila and Hueco areas by Cosgrove (1947, p. 125).

Reed Stalks Mounted on Reed Stems

These artifacts from Tularosa Cave consist of a segment of the lowest portion of the reed (*Phragmites* sp.) stalk, cut at a node, which is impaled on a segment of the stem (Fig. 160). No similar artifacts have been reported, with the possible exception of Bee Cave in Texas, where "a cut and tapered piece of reed inserted into another section of reed cut for the purpose" was found (Coffin, 1932, p. 31).

Reed Flutes

Four reed fragments with holes cut in one side have been identified as flutes (Fig. 161). All are from Tularosa Cave, and each exhibits individual variations.

The absence of reed flutes after the Georgetown Phase in Tularosa Cave does not necessarily indicate that this artifact was not used during later times, since occurrences of flutes in nearby "Pueblo" period sites are reported by Cosgrove.

A comparison with flutes from other sites indicates that while there are some common characteristics, all of the reported specimens vary individually. Flutes are so rare that valid culturally associated traits cannot as yet be identified.

Flutes are reported from the following sites or areas:

Site	*Reference*
Anasazi:	
Canyon Creek Ruin	Haury, 1934, p. 114
Kayenta area	Kidder and Guernsey, 1919, p. 186
Pueblo Bonito	Pepper, 1920, pp. 108–109
Hohokam:	
Ventana Cave	Haury, 1950, p. 425
Mogollon:	
Upper Gila area	Cosgrove, 1947, p. 120
Great Basin:	
Gypsum Cave	Harrington, 1933, pp. 149–150
Promontory Cave 1	Steward, 1937, p. 42
Trans-Pecos:	
Fate Bell Shelter	Pearce and Jackson, 1933, pp. 132–135

Sticks with Incised Patterns in Bark

These artifacts (Fig. 148, *c*), each with different decorative patterns, are from Tularosa Cave. They probably represent pahos of some kind. One stick with a similar zigzag incised decoration is reported from Bear Creek Cave by Hough (1914, Fig. 344).

Wooden Cylinders

Wooden cylinders (Fig. 162) are made of straight peeled sticks of varying lengths with the ends cut off at right angles to the long axis and carefully smoothed.

Similar cylinders have been variously described as nose plugs, gaming sticks or counters, and sticks used in the ends of burden straps. The Tularosa and Cordova specimens fall within the same size range as the various wooden cylinders reported from other sites in the Southwest.

Wooden cylinders are reported from the following sites or areas:

Site	*Reference*
Anasazi:	
Aztec Ruin	Morris, 1919, p. 45
Kayenta, Basketmaker	Kidder and Guernsey, 1919, p. 186
Cliff Dweller	Kidder and Guernsey, 1919, p. 123
Mesa Verde sites	Nordenskiold, 1893, Pl. 49
Pueblo Bonito	Pepper, 1920, p. 108
Spruce Tree House	Fewkes, 1909, p. 44
Hohokam:	
Ventana Cave	Haury, 1950, p. 421
Mogollon:	
Tularosa Cave	Hough, 1914, p. 61
Upper Gila and Hueco areas	Cosgrove, 1947, p. 152
Great Basin:	
Fremont, Site 11	Morss, 1931, p. 62
Gypsum Cave	Harrington, 1933, p. 143

Sticks with Fiber, Sinew and Hair Binding

These short segments of rough sticks (Fig. 163) have a variety of wrappings. They are most frequent in the earlier phases in Tularosa Cave. They seem to fall into the Unpeeled Twig Paho category described by Cosgrove (1947, p. 125) and are found in both the Upper Gila and Hueco areas.

Twigs Tied in Loops

These artifacts, from Tularosa Cave, consist of small twigs bent into coiled loops at one end and tied in place. They fall into the Unpeeled Twig Pahos category of Cosgrove (1947, p. 125, Fig. 118, *k*) and were found in both the Upper Gila and Hueco areas.

Sticks with Knotted Yucca Leaf Bindings

These artifacts are small branches or twigs, each with a yucca leaf bound once around the center and knotted to form a large ball of fiber on one side of the stick (Fig. 150, *a*, *b*). They occur in the San Francisco-through-Tularosa levels of Tularosa Cave.

Sticks with agave fiber bindings are reported from Winchester Cave (Fulton, 1941, p. 34) and stones and bones with grass bindings are reported from sites in the Trans-Pecos (Pearce and Jackson, 1933, pp. 115–117; Coffin, 1932, p. 24; Martin, G. C., 1933b, p. 83), but there are no reported parallels of these Tularosa Cave artifacts.

Hoops

Hoops (Fig. 164), with and without nets, were recovered from Tularosa Cave. Similar artifacts are reported from the Upper Gila area and from Promontory Cave 1.

Site	*Reference*
Mogollon:	
Upper Gila area	Hough, 1914, Pl. 12, no. 2 Cosgrove, 1947, p. 154, Fig. 111
Great Basin:	
Promontory Cave 1	Steward, 1937, p. 24

Curved Grooved Clubs

Curved clubs decorated with groups of three or four parallel incised grooves, referred to as fending sticks associated with the atlatl, are characteristic of Basketmaker sites of the Anasazi area and of the Pecos River Focus sites of the Trans-Pecos area. They are reported from the Hueco and Guadalupe areas. Six fragments were recovered from Ventana Cave (Haury, 1950, p. 420). Only three fragments are reported from the Upper Gila area of New Mexico, and none were recovered from either Tularosa or Cordova.

The small number of fragments recovered from the Upper Gila caves in the surveys and excavations of Hough and Cosgrove and the absence of these artifacts from these new cave collections are striking. The conditions of preservation in the sites in the area are such that it would be reasonable to expect more fragments of these artifacts to have been reported if the curved grooved club were actually a characteristic of the Mogollon culture in the Upper Gila region.

Curved grooved clubs are reported from the following sites:

Site	*Reference*
Anasazi:	
Heaton's Cave	Judd, 1926, p. 147
White Dog Cave	Guernsey and Kidder, 1921, pp. 88–89
Hohokam:	
Ventana Cave	Haury, 1950, p. 420
Mogollon:	
Caves of Upper Gila and Hueco	Cosgrove, 1947, pp. 58–60
Guadalupe:	
Hermit's Cave	Ferdon, 1946, p. 19

Great Basin:	
Gypsum Cave	Harrington, 1933, p. 120
Trans-Pecos:	
Bee Cave	Coffin, 1932, p. 28
Fate Bell Shelter	Pearce and Jackson, 1933, p. 44, Pl. 9
Murrah Cave	Holden, 1937, p. 66
Shelby Brooks Cave	Jackson, 1937, p. 161
Shumla Cave	Martin, G. C., 1933b, pp. 30–32

Hardwood Paddles

Hardwood paddles with rectangular blades and narrow handles are reported from the Classic period sites of the Hohokam culture. They are also reported from Ventana Cave and Casa Grande.

> Wooden tools of the type described from Los Muertos are commonly called pottery paddles, a logical assumption, as most of the pottery was paddle and anvil made. But modern paddles do not display the distinctive beveled end. One surface is usually slightly concave, so as to conform to the shape of the vessels made, and the blades are thicker. These features are lacking in the archaeological paddles. It is conceivable that the latter were used by potters although their chief purpose may have been for digging and hand cultivation (Haury, 1945a, p. 162).

None of the wood and bark trowels previously discussed from Mogollon sites resemble these paddles. While the Hohokam paddles may have been used as digging implements, the lack of similar artifacts in Anasazi and Mogollon sites, and the presence in such sites of corn cobs used as pottery smoothers (Fig. 149, *j*) indicate the possible importance of this trait, which distinguishes the late Hohokam from other Southwestern cultures.

Site	*Reference*
Hohokam:	
Casa Grande	Fewkes, 1912, p. 146
Classic Period sites	Haury, 1945a, p. 162
Ventana Cave	Haury, 1950, p. 417

Billets

Rectangular wooden blocks, often found as head rests for burials, are called billets and are reported from several Pueblo III sites and from Ventana Cave. No similar artifacts are present in Tularosa or Cordova caves, and Cosgrove reported none from the Upper Gila.

Billets are reported from the following sites:

Site	*Reference*
Anasazi:	
Betatakin	Judd, 1931, p. 56
Canyon Creek Ruin	Haury, 1934, p. 104
Cave 2, Segi	Guernsey, 1931, pp. 62, 107–108
Cliff Palace	Fewkes, 1911, pp. 73–74
Kayenta, Cliff Dwellings	Kidder and Guernsey, 1919, p. 119
Hohokam:	
Ventana Cave	Haury, 1950, p. 423

Summary and Conclusions

One of the problems of this chapter was a test of the hypothesis that the Mogollon is a distinct cultural entity. The test was based upon new data: wooden artifacts associated with typical Mogollon imperishable remains.

The wooden specimens recovered from the caves have been treated in two basic ways in an attempt to assess their significance. One of these was a comparison with wooden artifacts from other sites in the Southwest and peripheral areas. The other is a relative percentage seriation of the Tularosa Cave collection. These two approaches provide some information concerning relationships of Mogollon with other Southwestern cultures and cultural shifts within Mogollon.

The varying proportions of certain wooden artifacts in the Tularosa Cave sequence reflect cultural changes that can be properly evaluated only when considered against the background of cultural continuity indicated by traits that are present in all phases from the Pre-Pottery through the San Francisco. The persistent wooden artifacts are atlatl equipment, wooden cylinders, Juniper-berry skewers, sticks with fiber sinew or hair binding, split sticks, sticks with incised patterns in bark, feathers mounted on sticks, digging sticks, wooden dice, wood and bark trowels, twigs tied in loops, worked gourd fragments, and burred piece-feather carders.

An increase in cultural complexity following the Pre-Pottery phase is reflected by the presence of a greater variety of wooden artifacts in the levels of the Pine Lawn Phase. These Pine Lawn additions are reed cigarettes, toggles, reed tubes, corn cobs mounted on sticks, and reed stalks mounted on reed stems.

A second series of variations in the wooden artifact assemblage which reflects shifting cultural emphasis is associated with the San Francisco Phase and distinguishes it from the preceding Georgetown Phase. The changes occurring in the San Francisco Phase are the introduction and/or increased use of the bow and arrow; introduction of ceremonial and miniature bows and arrows; introduction of painted sticks; introduction of sticks with knotted yucca leaf bindings; absence of reed flutes; a shift from plano-convex to cylindrical fire drill hearths; increase in reed cigarettes; decline in Juniper-berry skewers; decline in wooden cylinders; decline in split sticks; decline in sticks with fiber and sinew and hair bindings; decline in bark trowels; decline in wooden dice; decline in twigs tied in loops; and decline in worked gourd.

Temporal shifts in the popularity of the various types of wooden artifacts have been determined by comparing their relative percentages in each of the sequential phases of the cave occupation. Figure 131 presents the number and percentage of wooden artifacts associated with each phase or series of mixed levels. This table includes data concerning only artifact categories represented by four or more specimens.

One difficulty in the analysis of these relative percentages arises from the disturbance in the upper levels of the cave midden. The San Francisco-Reserve-Tularosa mixture, coupled with the small number of "pure" Reserve–Tularosa levels (2), makes it impossible to determine whether some changes in the popularity of wooden artifacts are associated with the San Francisco Phase or with the Reserve and Tularosa phases, since the shifts occur in the mixed levels.

Figure 131 includes several categories of artifacts that show trends through time, but the percentage variations are not large. The number of artifacts in these categories is small and most of the variations do not represent significant deviations from the expected frequency, assuming a random distribution.

However, some of these variations become more clear cut in a seriation based upon three groups of phases rather than on individual phases or mixed levels. The three units used in the second seriation are the Pre-Pottery, the Pine Lawn–Georgetown combined and the San Francisco-Reserve-Tularosa combined. Figures 130 and 132 present the numbers and percentages and a graphic seriation of these three units. While the second seriation has the advantage of clarifying trends in artifact categories represented by few specimens, it also obscures some of the details of the gradual shifts illustrated in Figure 131. Hence both seriations are offered.

The following interpretation of the data presented in Figures 130–132 indicates the major cultural trends that are reflected in the relative proportions of wooden artifacts associated with particular phases of the Tularosa Cave sequence.

One cultural-temporal shift illustrated by the seriation of wooden artifacts is a change in weapons—a change associated with the San Francisco Phase. The atlatl was the main weapon in use from Pre-Pottery times through the Georgetown Phase. The bow and arrow was introduced during the San Francisco Phase and increased in importance thereafter, while the atlatl declined. Both weapons were in simultaneous use during the San Francisco Phase, but the

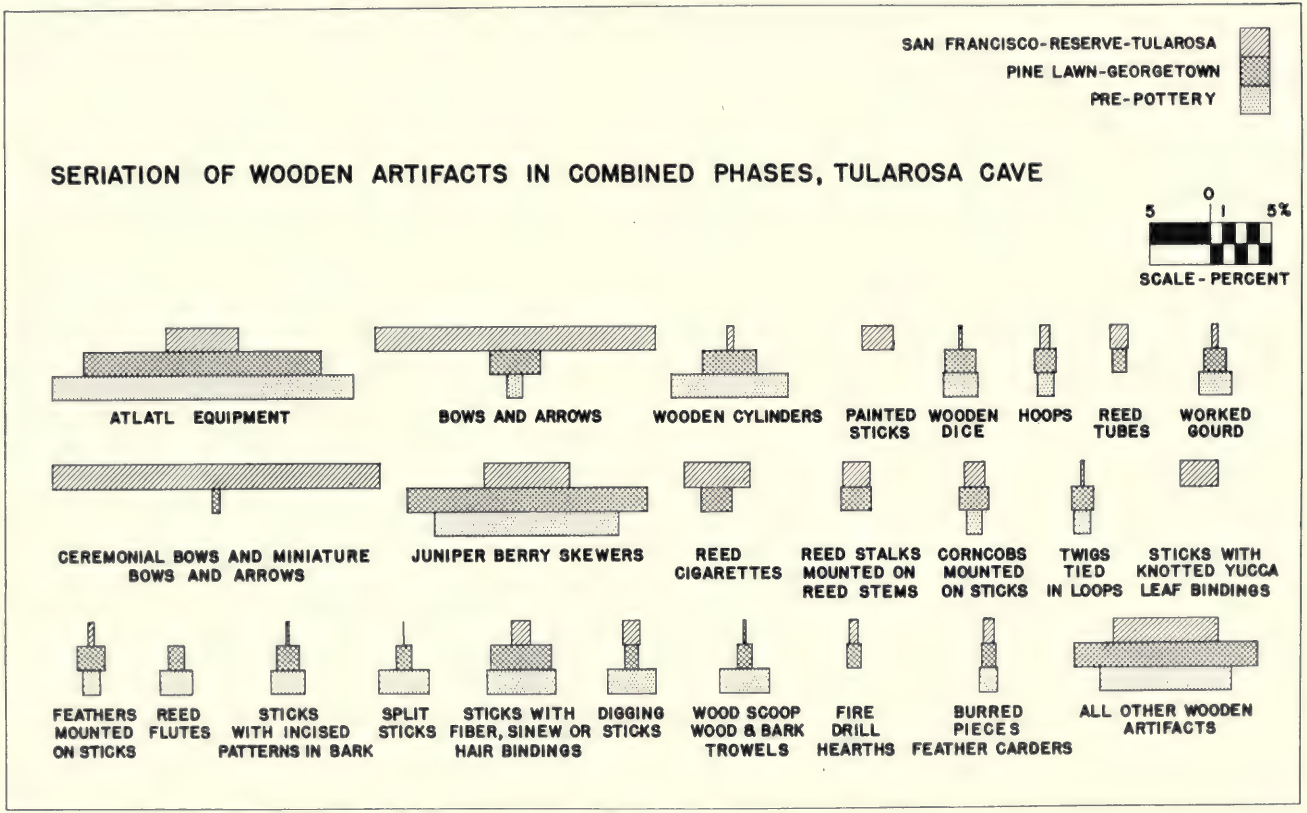


FIG. 130. Seriation of wooden artifacts in combined phases, Tularosa Cave.

	ATLATL EQUIPMENT	BOWS AND ARROWS	DIGGING STICKS	WOOD SCOOP, WOOD AND BARK TROWELS	FIRE DRILL HEARTHS	BURRED PIECES; FEATHER CARDERS (?)	CEREMONIAL BOWS & MINIATURE BOWS AND ARROWS	JUNIPER BERRY SKEWERS	REED CIGARETTES	PAINTED STICKS	WOODEN DICE	REED STALKS MOUNTED ON REED STEMS	CORN COBS MOUNTED ON STICKS	FEATHERS MOUNTED ON STICKS	REED FLUTES	STICKS WITH INCISED PATTERNS IN BARK	WOODEN CYLINDERS, PLAIN	SPLIT STICKS	STICKS WITH FIBER, SINEW OR HAIR BINDINGS	HOOPS	TWIG TIED IN LOOPS	REED TUBES	STICKS WITH KNOTTED YUCCA LEAF BINDINGS	WORKED GOURD FRAGMENTS	ALL OTHER WOODEN ARTIFACTS	TOTAL WOODEN ARTIFACTS	TOTAL PERCENTAGES
RESERVE-TULAROSA		12 *30.78*	1 *2.56*				20 *51.28*		5 *12.82*														1 *2.56*			39	*100*
SAN FRANCISCO-TULAROSA	8 *3.90*	48 *23.51*	2 *.97*		2 *.97*		63 *30.73*	16 *7.80*	10 *4.87*	7 *3.41*		4 *1.95*	1 *.48*	2 *.97*			1 *.48*	1 *.48*	3 *1.46*	2 *.97*	1 *.48*	3 *1.46*	11 *5.36*		20 *9.75*	205	*100*
SAN FRANCISCO	13 *12.74*	22 *21.50*	2 *1.96*	1 *.98*	1 *.98*	4 *3.92*	13 *12.74*	9 *8.82*	4 *3.92*	2 *1.96*	1 *.98*	4 *3.92*	5 *4.90*			1 *.98*	1 *.98*	1 *.98*	2 *1.96*	1 *.98*		2 *1.96*	1 *.98*	2 *1.96*	10 *9.80*	102	*100*
GEORGETOWN	18 *21.17*	5 *5.88*	2 *2.35*	1 *1.17*	1 *1.17*	1 *1.17*		14 *16.47*	3 *3.52*		3 *3.52*	2 *2.35*		4 *4.70*	1 *1.17*	2 *2.35*	2 *2.35*	2 *2.35*	5 *5.88*	1 *1.17*	2 *2.35*	1 *1.17*		2 *2.35*	13 *15.39*	85	*100*
PINE LAWN-GEORGETOWN	1 *12.50*			1 *12.50*				4 *50.00*									1 *12.50*		1 *12.50*							8	*100*
PINE LAWN	12 *19.35*	2 *3.22*			1 *1.61*	1 *1.61*	1 *1.61*	13 *20.96*	1 *1.61*		1 *1.61*	2 *3.22*	4 *6.45*		1 *1.61*	1 *1.61*	4 *6.45*		2 *3.22*	2 *3.22*	1 *1.61*	1 *1.61*		1 *1.61*	11 *17.81*	62	*100*
PRE-POTTERY	18 *25.40*	1 *1.40*	3 *4.23*	3 *4.23*		1 *1.40*		11 *15.49*			2 *2.82*		1 *1.40*	1 *1.40*	2 *2.82*	2 *2.82*	7 *9.85*	3 *4.23*	4 *5.63*	1 *1.40*	1 *1.40*			2 *2.82*	8 *11.26*	71	*100*
UNPLACED	4	5							2										1				1	1	2	16	
TOTAL	74	95	10	6	5	7	97	67	25	9	7	12	11	7	4	6	16	7	18	7	5	7	14	8	64	588	

FIG. 131. Chart showing distribution of wooden artifacts by phases, Tularosa Cave.

	ATLATL EQUIPMENT	BOWS AND ARROWS	DIGGING STICKS	WOOD SCOOP, WOOD AND BARK TROWELS	FIRE DRILL HEARTHS	BURRED PIECES; FEATHER CARDERS (?)	YUCCA LEAF SPINE NEEDLES	CEREMONIAL BOWS & MINIATURE BOWS AND ARROWS	JUNIPER BERRY SKEWERS	REED CIGARETTES	TABLITAS	PAINTED STICKS	WOODEN DICE	REED STALKS MOUNTED ON REED STEMS	CORN COBS MOUNTED ON STICKS	FEATHERS MOUNTED ON STICKS	REED FLUTES	STICKS WITH INCISED PATTERNS IN BARK	WOODEN CYLINDERS; PLAIN	SPLIT STICKS	STICKS WITH FIBER, SINEW OR HAIR BINDINGS	REED TUBE AND CORD; SNARES (?)	HOOPS	TWIG TIED IN LOOPS	REED TUBES	STICKS WITH KNOTTED YUCCA LEAF BINDINGS	WORKED GOURD FRAGMENTS	ALL OTHER WOODEN ARTIFACTS	TOTAL WOODEN ARTIFACTS	TOTAL PERCENTAGES
TULAROSA CAVE																														
SAN FRANCISCO-TULAROSA	21 *6.06*	82 *23.79*	5 *1.44*	1 *.28*	3 *.86*	4 *1.15*		96 *27.79*	25 *7.22*	19 *5.49*		9 *2.60*	1 *.28*	8 *2.31*	6 *1.73*	2 *.57*		1 *.28*	2 *.57*	2 *.57*	5 *1.44*		3 *.86*	1 *.28*	5 *1.44*	13 *3.75*	2 *.57*	30 *8.67*	346	*100*
PINE LAWN-GEORGETOWN	31 *20.02*	7 *4.51*	2 *1.29*	2 *1.29*	2 *1.29*	2 *1.29*		1 *.64*	31 *20.02*	4 *2.58*			4 *2.58*	4 *2.58*	4 *2.58*	4 *2.58*	2 *1.29*	3 *1.93*	7 *4.51*	2 *1.29*	8 *5.16*		3 *1.93*	3 *1.93*	2 *1.29*		3 *1.93*	24 *15.49*	155	*100*
PRE-POTTERY	18 *25.40*	1 *1.40*	3 *4.22*	3 *4.22*		1 *1.40*			11 *15.54*				2 *2.81*		1 *1.40*	1 *1.40*	2 *2.81*	2 *2.81*	7 *9.85*	3 *4.22*	4 *5.63*		1 *1.40*	1 *1.40*			2 *2.81*	8 *11.28*	71	*100*
TOTAL	70	90	10	6	5	7		97	67	23		9	7	12	11	7	4	6	16	7	17		7	5	7	13	7	62	572	
CORDOVA CAVE																														
LATE	3	21	1		3		6	11	2	2	39	7	1						2	6	1	5						12	122	
PLAIN WARE	4	1		1	2	1	1		1	1	4	1	1						5	1							1	1	26	
PRE-POTTERY	5		1	3	2							1								3							1	4	20	
TOTAL	12	22	2	4	7	1	7	11	3	3	43	9	2						7	10	1	5					2	17	168	
TOTAL BOTH CAVES	82	112	12	10	12	8	7	108	70	26	43	18	9	12	11	7	4	6	23	17	18	5	7	5	7	13	9	79	740	

FIG. 132. Chart showing distribution of wooden artifacts by combined phases, Tularosa Cave, and by phases, Cordova Cave.

bow and arrow may have been known somewhat earlier, as indicated by arrows in the preceding Georgetown, Pine Lawn and Pre-Pottery levels. In any case, the real acceptance of the bow and arrow occurred during the San Francisco Phase. The phase distribution of the ceremonial and miniature bows and arrows supports this interpretation. The absence of atlatl equipment in the Reserve–Tularosa levels, coupled with the decrease in the San Francisco-Reserve-Tularosa mixed levels, may be interpreted as indicating the possibility that the atlatl was not used after the San Francisco Phase.

took over the Jun. Berry

The ceremonial and miniature bows and arrows, with the exception of one specimen from a Pine Lawn level (probably the result of midden disturbance), first appeared in the San Francisco Phase and steadily increased in popularity thereafter.

The Juniper-berry skewer, on the other hand, had a climax of popularity during the Pine Lawn and Georgetown phases and a subsequent decline in the San Francisco Phase. As with the atlatl, this artifact may not have continued in use after the end of the San Francisco Phase.

Reed cigarettes first appeared in the Pine Lawn Phase and steadily increased in popularity until they reached a climax in the Reserve–Tularosa mixed levels. The addition of a new type of decoration on reed cigarettes is also associated with the latter phases.

Assuming that ceremonial activities are reflected in the associated material paraphernalia, and that the miniature bows and arrows, Juniper-berry skewers, and reed cigarettes had ceremonial functions, a comparison of the seriation of these three groups of artifacts leads to the conclusion that a shift in ceremonial activity was initiated during the San Francisco Phase and increased in importance and elaboration thereafter, although it did not obscure the older patterns. The new trend may have reduced the activities associated with the Juniper-berry skewers but it did not prevent the increasing development of the reed cigarette complex. The simultaneous adoption of the bow and arrow and some form of ceremonial recognition of the new weapon seem clearly indicated.

Wooden cylinders occur in the greatest relative percentages in the Pre-Pottery levels and decrease in subsequent phases.

Sticks with fiber, sinew, or hair bindings were recovered from all phases except the Reserve–Tularosa. They decrease in popularity during the San Francisco Phase. The hair binding was introduced during that phase.

Corn cobs mounted on sticks occur in the largest percentages in the Pine Lawn and San Francisco phases. Though no specimens were recovered from the levels of the Georgetown Phase, the analysis of the cobs provides good evidence that these artifacts were used from Pine Lawn times throughout the occupation. The one Pre-Pottery specimen consists of a cob that probably came from the Pine Lawn and Georgetown phases, and these artifacts were probably not in use during Pre-Pottery times.

Other trends in wooden artifacts indicated by the seriation have been listed at the beginning of this section; further information is required for the confirmation of these tentatively suggested shifts in the frequency of wooden artifacts.

The Cordova Cave occupation was divided into three phases on the basis of stratigraphy and ceramic remains. These phases correspond with the three groups of combined phases used in the seriation of the Tularosa Cave wooden artifacts: Pre-Pottery, Plain Ware, which is equivalent with Pine Lawn–Georgetown combined, and Late, which is equated with San Francisco-Reserve-Tularosa.

Figure 132 presents the frequency of wooden artifacts in Cordova Cave and, in general, confirms the Tularosa Cave seriation. Exceptions are the split sticks, which do not decline in the Late Phase as at Tularosa Cave, and the fire drill hearths, which do not show the shift from plano-convex to cylindrical cross section. New types of artifacts probably introduced during the Late Phase (post-Georgetown) in Cordova Cave are tablitas, yucca leaf spine needles, reed tube and cord (snare).

The trends indicated in the seriation of the Tularosa Cave wooden artifacts parallel the developments in Mogollon culture known from previous studies of pottery, stone, and bone tools. The increase in number of wooden artifact types in the Pine Lawn Phase parallels the addition of pottery, which distinguishes the Pine Lawn Phase from the Cochise complex. The Georgetown–San Francisco phase shift in wooden artifacts parallels some previously suggested modifications of the Mogollon tradition during the San Francisco Phase; for example, the addition of new pottery types. While the evidence furnished by the Tularosa and Cordova Cave collections is not definite, it seems reasonable to postulate that further modifications of the perishable artifact assemblage occurred during the Reserve and Tularosa phases.

Good

Evidence linking Mogollon and other Southwestern cultures comes from the following relationships among the artifacts studied:

1. Artifacts which have identical or nearly identical counterparts in all Southwestern cultures:
    - (*a*) Pre-A.D. 700
        - Atlatl and equipment
        - Curved grooved club (?in Mogollon, Upper Gila)
        - Bark and wood trowels
        - Digging sticks
        - Wooden cylinders
    - (*b*) Post-A.D. 700
        - Bows and arrows
        - Digging sticks
        - Slotted fire drill hearths
        - Wooden cylinders
        - Painted sticks
        - Carved pahos
        - Reed cigarettes
        - Corn cobs mounted on sticks
        - Ceremonial and miniature bows and arrows
        - Burred pieces (feather carders; ?in Anasazi)
2. Artifacts occurring first in other cultures and late in Mogollon; diffusion to Mogollon:
    - Bow and arrow
    - Painted and carved pahos
    - Cylindrical fire drill hearth(?)

Evidence supporting the Mogollon hypothesis is derived from:

1. Artifacts found only in Mogollon:
    - Juniper-berry skewers
    - Reed stalks impaled on reed stems
    - Sticks with knotted yucca leaf bindings
    - Sticks with incised patterns in bark
    - Twigs tied in loops
    - Feathers bound to sticks
    - Sticks with fiber, sinew and hair bindings
    - Tablitas
2. Artifacts not reported from Mogollon but occurring in other Southwestern cultures:
    - Hardwood pottery paddles
    - Wooden billets

3. Variations of form or decoration which are associated with only one culture but are found in artifacts common to all Southwestern cultures:
    - Atlatl equipment: Anasazi; heart-shaped channel; possible lack of atlatls with rectangular distal end
    - Fire drill hearth: possible pre-A.D. 700 Mogollon use of plano-convex hearth, later use of cylindrical hearth
    - Arrows: complex painted decoration characteristic of some Upper Gila (Mimbres) specimens
    - Digging sticks: sword-shaped blade and knob handle in Pueblo III and Salado
    - Reed cigarettes: Anasazi, undecorated; Salado and/or Hohokam, woven sashes and bundles of cigarettes; Mogollon, elaborate bundles used as decoration and painted decorations
    - Corn cobs mounted on sticks: Anasazi; polished sticks, two cobs mounted butt to butt, use of arrow shafts as sticks
4. Artifacts occurring earlier in Mogollon and later in other Southwestern cultures; possibility of diffusion from Mogollon:
    - Reed cigarettes
    - Corn cobs mounted on sticks
    - Ceremonial bows and miniature bows and arrows

Many of the Pre-Pottery specimens (not included in the above list) from the caves fall in this latter category, but their significance may be more apparent than real because of the lack of equally early materials in other areas, and their interpretation as Mogollon forerunners of later, more widespread, traits must be considered only tentative until further evidence is available.

Good

General conclusions based upon the comparison of wooden artifacts are presented in a framework of two temporal units: pre-A.D. 700 and post-A.D. 700. This division was made because of the nature of the Tularosa and Cordova Cave collections in which the late occupation materials are greatly mixed, and because the seriation of wooden artifacts from Tularosa Cave indicated a series of cultural shifts during the San Francisco and/or subsequent phases in the Mogollon sequence represented in the cave.

General similarities in utilitarian artifacts (that is, atlatls, arrows, digging sticks, etc.) throughout the Southwest link its subcultures to one another both before and after A.D. 700. Some of these similarities also extend to the peripheral areas, but some peripheral area complexes can be suggested and contrasted with the general Southwestern pattern. Some local variations in utilitarian artifacts may be interpreted as traits distinguishing Anasazi, Hohokam, or Mogollon, but these traits are relatively unimportant when compared with the undeniable similarities which reflect a common basic culture pattern in the Southwest.

From Tularosa and Cordova caves before A.D. 700 there is a series of artifacts which may be classed as "ceremonial" (that is, reed cigarettes, Juniper-berry skewers and so on) and which are apparently unique to the Mogollon culture and serve to contrast it with the contemporary Basketmaker to the north.

The seriation of wooden artifacts from Tularosa Cave indicated the beginning of increasingly important cultural shifts in both utilitarian and ceremonial artifacts during the San Francisco Phase, and the introduction of new artifacts at the same time reflects an increase in cultural complexity. Though data are not available for Pueblo I and II, the similarity of the Pueblo III artifacts with those of the late occupation in the Upper Gila area clearly indicates the importance of Anasazi influences on the Mogollon, presumably beginning around A.D. 700. At Tularosa Cave there is evidence that at least some elements of the Mogollon culture survived the influx of new traits during the San Francisco Phase, but the general impression derived from the comparative analysis of wooden artifacts is that after A.D. 700 Southwestern cultures became increasingly similar until, by Pueblo III times, there are only a few wooden artifacts that exhibit regional variations. Previous analyses of imperishable materials present a similar developmental pattern. At the same time (that is, after the A.D. 700 time horizon) the Southwest becomes increasingly different from the peripheral areas; the Basin lacks the complex ceremonial equipment characteristic of the Southwest, and the Pecos River Focus represents a survival of a culture pattern similar to that of pre-A.D. 700 times in the Southwest proper.

The over-all parallelism in culture pattern and development discussed in terms of a Southwestern Co-Tradition (Martin and Rinaldo, 1951) is reflected in the wooden artifacts from the area. The cultural shift during the San Francisco Phase falls within the Formative stage of the Co-Tradition (Martin and Rinaldo, 1951, p. 220), but the suggested Pueblo III date for widespread similarity in most types of wooden artifacts coincides with the beginning of the Classic stage of the Co-Tradition. The shift at A.D. 700 may be interpreted as indicating a needed division of the Formative in the Southwestern Co-Tradition, but the suggestion can only be regarded as a tentative one.

To sum up, the analysis of wooden artifacts from Tularosa and Cordova caves—typical Mogollon sites—has shown that:

1. There are some traits that distinguish Mogollon from Anasazi, especially before A.D. 700.

2. After A.D. 700 all Southwestern cultures become increasingly similar.

3. The Southwest can be contrasted with the surrounding peripheral areas, but some similarities exist between them.

There is, then, derived from the new data evidence which supports the Mogollon hypothesis, but that the Mogollon culture is a part of the broader Southwestern Co-Tradition cannot be denied.

Description

LIST OF SPECIMENS

	Number Excavated	
Object	Tularosa Cave	Cordova Cave
Atlatl fragments	6	..
Unfinished atlatls(?)	3	..
Atlatl dart mainshaft fragments	11	6
Atlatl dart foreshafts	37	3
Atlatl dart foreshaft discards and blanks	13	1
Atlatl dart bunts	4	2
Bow fragments	1	2
Arrow mainshafts and foreshafts	94	20
Digging sticks	10	2
Wooden trowels	2	1
Wooden scoops	1	1
Bark trowels	3	2
Fire drill hearths	5	7
Fire drills	3	..
Spoon and ladle	2	..
Knife handles	..	2
Wooden awls	2	..
Spindles	2	1
Weaving tool	1	..
Glue brush	..	1
Pitch container	1	..
Snares	1	1
Snare trigger(?)	1	..
Hooks	2	..
Burred pieces (feather carders?)	7	1
Burred cylinders	1	1

LIST OF SPECIMENS—*continued*

Object	*Number Excavated* Tularosa Cave	 Cordova Cave
Tubular container	..	1
Yucca leaf spine needles	..	6
Yucca leaf brush	..	1
Toggles(?)	4	..
Spatula-like objects	2	2
Torches	2	..
Split stick tongs(?)	2	1
Seed beater(?)	1	..
Ceremonial bows	50	5
Miniature bows and arrows	47	6
Juniper-berry skewers	64	3
Reed cigarettes	25	3
Tablitas	..	43
Painted sticks	9	9
Carved paho	..	1
Crook fragment(?)	1	..
Wooden dice	7	2
Corn cobs mounted on sticks	11	..
Corn cobs mounted on feathers	2	..
Feathers mounted on sticks	7	1
Reed stalks mounted on reed stems	12	..
Reed flutes	4	..
Sticks with incised patterns in bark	6	..
Wooden cylinders	20	7
Split sticks	7	10
Skewer with seeds impaled on it	1	..
Sticks with fiber, sinew or hair bindings	19	2
Hoops	7	..
Hoop-like objects	3	..
Twigs tied in loops	5	..
Sticks with knotted yucca leaf bindings	14	..
Bark pendant	1	..
Tooth-marked stick	1	..
Flattened stick	1	..
Lap board fragments(?)	3	..
Carved wooden object (pendant?)	1	..
Sticks bound together	7	1
Curved worked twig	1	1
Stake	1	..
Rasp(?)	..	1
Bundle of sticks; stock material	1	..
Charred, shouldered, pointed sticks	5	..
Reed tube and cord (snares?)	..	4
J-shaped split stick	..	1
Reed tubes	7	..
Fiber-capped reed	1	..
Worked cane	1	..
Corn cob pottery smoother	1	..
Worked gourd		
Vessel	1	..
Fragments	4	1
Ring	1	..
Disk	1	1
Pendant	1	..
Miscellaneous fragments of worked wood	110	237

Atlatl Fragments

DISTAL END FRAGMENTS

A. Blunt point (Fig. 133, *a*, *c*).

Technique.—Carved from piece of wood; all surfaces smoothed.

Shape.—Distal end tapers to blunt point; distal section tapers both in width and thickness towards the proximal end; plano-convex in cross section; channel in flat side; channel is short, has rounded bottom, tapers in depth and width toward the proximal end and is located midway between sides of the atlatl; spur is formed by undercutting at end of channel; spur protrudes into channel and is flush with flat surface of the atlatl.

Decoration.—None.

Material.—Oak (*Quercus* sp.).

Occurrence by Phases, Tularosa Cave.—Pre-Pottery, 1; unplaced, 1 (charred, no dimensions given).

Dimensions.—Length, 21.4 cm. (fragment); width, 2.9 cm.; thickness, 0.9 cm.; channel length, 3.5 cm.; channel width, 1.0 cm. (tapers to 0.6 cm.); channel depth, 0.6 cm.; spur length, 0.7 cm.; spur width, 0.8 cm. (tapers to rounded point); end of spur and channel 3.7 cm. from distal end.

B. Rectangular (Fig. 133, *b*).

Technique.—Carved from single piece of wood; all surfaces smoothed and polished.

Shape.—Distal end rectangular in outline with rounded corners; slight taper towards proximal end; plano-convex in cross section; channel in flat side; channel tapers slightly in both width and depth but shows no signs of ending over length of fragment; channel straight-sided with rounded bottom; spur formed by undercutting at end of channel; spur protrudes into channel and is flush with surface of atlatl.

Decoration.—None.

Special Features.—At fractured edge, near one side, are three small drilled holes, one with fragment of fiber remaining in it; evidence of repair of old break.

Material.—Oak (*Quercus* sp.).

Occurrence by Phase, Tularosa Cave.—Pre-Pottery, 1.

Dimensions.—Length, 8.7 cm. (fragment); width, 3.1 cm.; thickness, 0.7 cm.; channel length, 5.0 cm. (fragment); channel width, 1.0 cm. (tapers to 0.9 cm.); channel depth, 0.5 cm. (tapers to 0.3 cm.); spur length, 0.7 cm.; spur width, 0.7 cm. (tapers to rounded point); end of spur and channel 3.0 cm. from distal end.

PROXIMAL END FRAGMENTS

A. Plano-convex (Fig. 133, *e*).

Technique.—All surfaces and edges smoothed and polished.

Shape.—Plano-convex cross section with slight concavity in flat side; tapers in thickness and width towards proximal end; proximal end round in outline; edges are cut away at one point on opposite sides and resulting indentation wrapped with sinew; finger grip, but no loops remain.

Decoration.—None.

Material.—Oak (*Quercus* sp.).

Occurrence by Phase, Tularosa Cave.—Pre-Pottery, 1.

Dimensions.—Length, 18.7 cm. (fragment); width, 1.2 cm.; thickness, 0.9 cm.; width of leather binding, 2.5 cm. (binding begins 7.5 cm. from proximal end).

B. Miniature(?) (Fig. 133, *d*).

Technique.—All surfaces smoothed and polished.

Shape.—Rectangular cross section with rounded edges and slightly convex sides; rectangular in outline with slight indentation which begins to flare out again at break; indentation is too close to be finger grip unless fragment is a miniature.

Decoration.—None.

Material.—Oak (*Quercus* sp.).

Occurrence by Phase, Tularosa Cave.—San Francisco, 1.

Dimensions.—Length, 4.5 cm. (fragment); width, 1.5 cm.; thickness, 0.4 cm.; width of indentation, 1.3 cm.

CENTRAL FRAGMENT (FIG. 133, *f*)

Technique.—All surfaces smoothed and polished; gum or resin coating.

Shape.—Plano-convex in cross section; tapers in both width and thickness; ridge of sinew binding and marks of two other sinew bindings equally spaced along length; fractured at both ends.

Decoration.—None.

Material.—Oak (*Quercus* sp.).

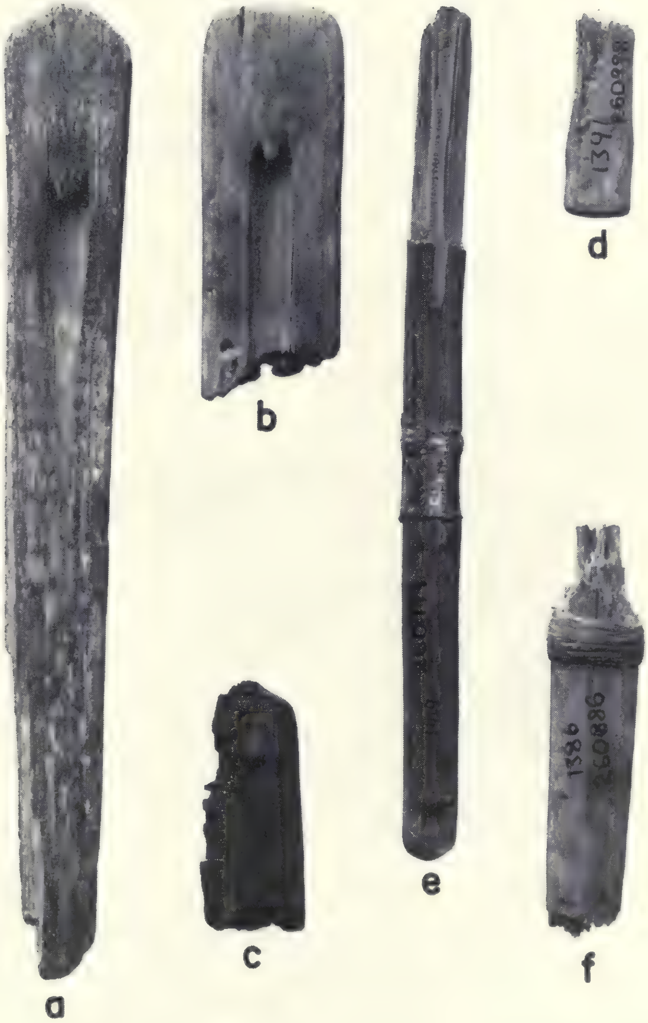

b
d
1341
260898
e
c
f
1386
260886
a

FIG. 133. Fragments of atlatl: *a*, *c*, blunt point at distal end; *b*, rectangular distal end; *d*, miniature(?) proximal end; *e*, plano-convex proximal end; *f*, central fragment. Length of *a*, 24.4 cm.

Occurrence by Phase, Tularosa Cave.—San Francisco, 1.

Dimensions.—Length, 8.9 cm. (fragment); width, 2.1 cm. (tapers to 1.8 cm.); thickness, 0.9 cm. (tapers to 0.5 cm.).

UNFINISHED ATLATLS(?) (FIG. 145, *a*)

Technique.—Worked boards, with cutting, splitting, and sawing marks on all surfaces.

Shape.—General size and shape give impression of atlatl; taper in width; one with narrow end smoothed (proximal end?); two with corners at wide end cut off at angle (start of a blunt point distal end?).

Material.—Pine (*Pinus ponderosa*).

Occurrence by Phases, Tularosa Cave.—Pre-Pottery, 1; San Francisco, 2.

Dimensions.—Length, 41.5, 41.0, 46.5 cm.; width, 3.5, 4.0, 2.5 cm.; thickness, 1.5, 1.0, 1.7 cm.

Atlatl Dart Mainshaft Fragments

CENTRAL SECTIONS

Technique.—Straight branches, bark removed, surfaces smoothed.

Shape.—Identified as mainshaft fragments by diameter and working of surfaces.

Material.—Willow (*Salix* sp.).

Occurrence by Phases, Tularosa Cave.—Pre-Pottery, 1; Georgetown, 1.

Dimensions.—Length, 44.1, 48.8 cm. (fragments); diameter, 1.1, 1.1 cm.

DISTAL END FRAGMENTS (FIGS. 134, *a*, 135, *c*)

Technique.—Straight branches; bark removed, surfaces smoothed; sockets drilled in ends; a hole of small diameter is drilled in the end and later enlarged as indicated by the one incomplete specimen.

Shape.—Cylindrical shaft; tapers toward proximal end; distal end cut off squarely at right angles to long axis of shaft; socket for foreshaft drilled in end; socket has a rounded bottom; marks of sinew wrapping around edge of socket.

Decoration.—None.

Material.—Willow (*Salix* sp.).

Occurrence by Phases, Tularosa Cave.—Pre-Pottery, 1 (incomplete); Georgetown, 1.

Dimensions.—Length, 15.3, 32.0 cm. (fragments); diameter, 1.4, 1.3 cm.; socket depth, 4.0 cm.; socket diameter, 1.1 cm.; incomplete socket, 1.0 cm. deep, 0.3 cm. in diameter.

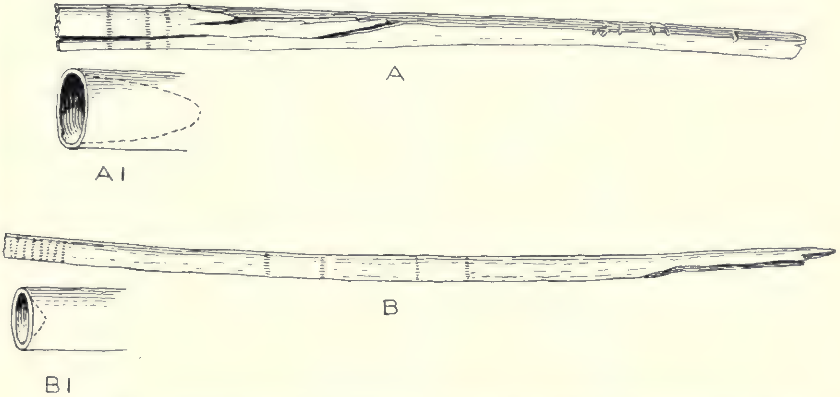


FIG. 134. Drawings of fragments of atlatl dart mainshaft: *a*, distal end; *a1*, socket at distal end; *b*, proximal end; *b1*, cup at proximal end.

PROXIMAL END FRAGMENTS (FIGS. 134, *b*, 135, *a*, *b*, *d*)

Technique.—Straight sticks; bark removed, surfaces smoothed; carving marks and spiral striations at end where diameter is reduced to fit channel in atlatl.

Shape.—Shaft tapers toward proximal end; shallow cup to engage atlatl spur carved in proximal end; edges of cup rounded and smooth; marks of sinew binding (reinforcement) around cup. Proximal end of specimen from Cordova Cave has a reduced diameter extending 0.6 cm. below cup.

Fletching.—No evidence of feathers; two marks of sinew binding remain; third binding may have been used either for attachment of feathers or for a finger grip.

Decoration.—None.

Material.—Willow (*Salix* sp.).

Occurrence by Phases, Tularosa Cave.—Pre-Pottery, 1; Georgetown, 5; unplaced, 1.

Occurrence by Phases, Cordova Cave.—Pre-Pottery, 2 (1 made of pithy wood); Plain Ware, 2; Late, 2.

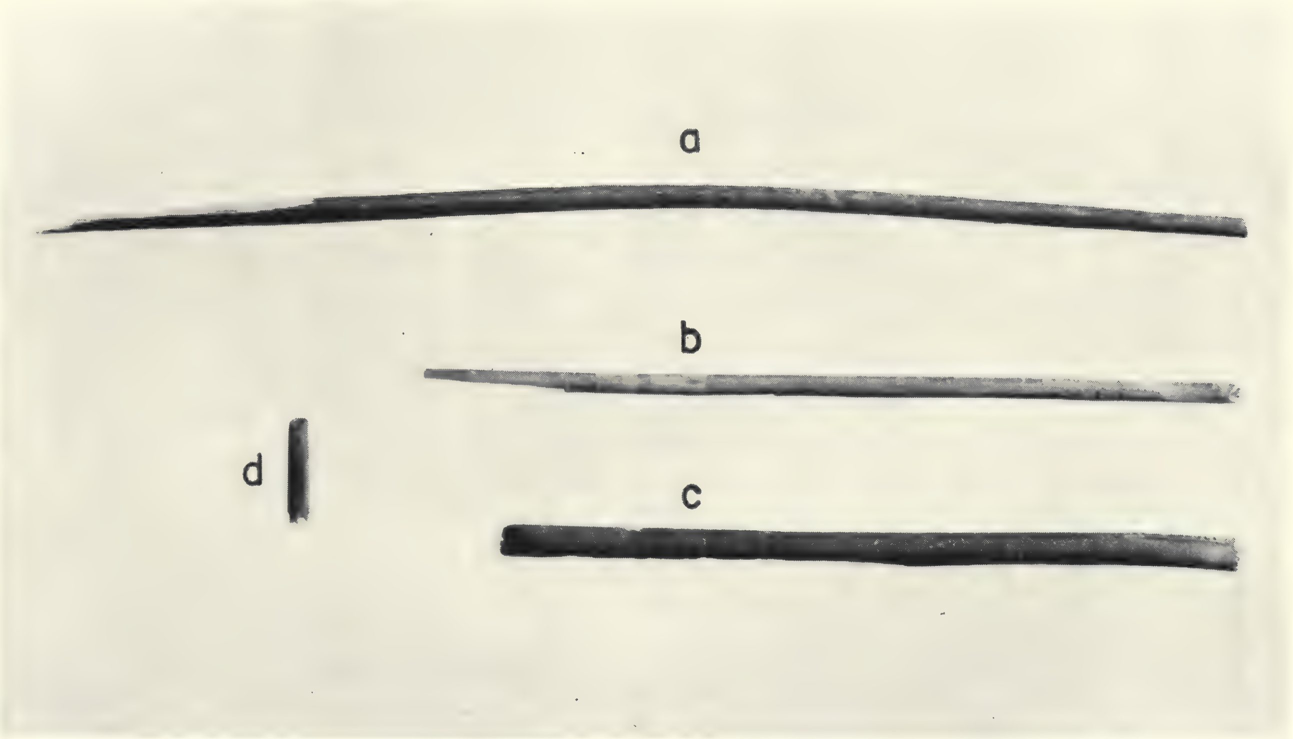


FIG. 135. Fragments of atlatl dart mainshaft: *a*, *b*, *d*, proximal ends; *c*, distal end. Length of *c*, 32 cm.

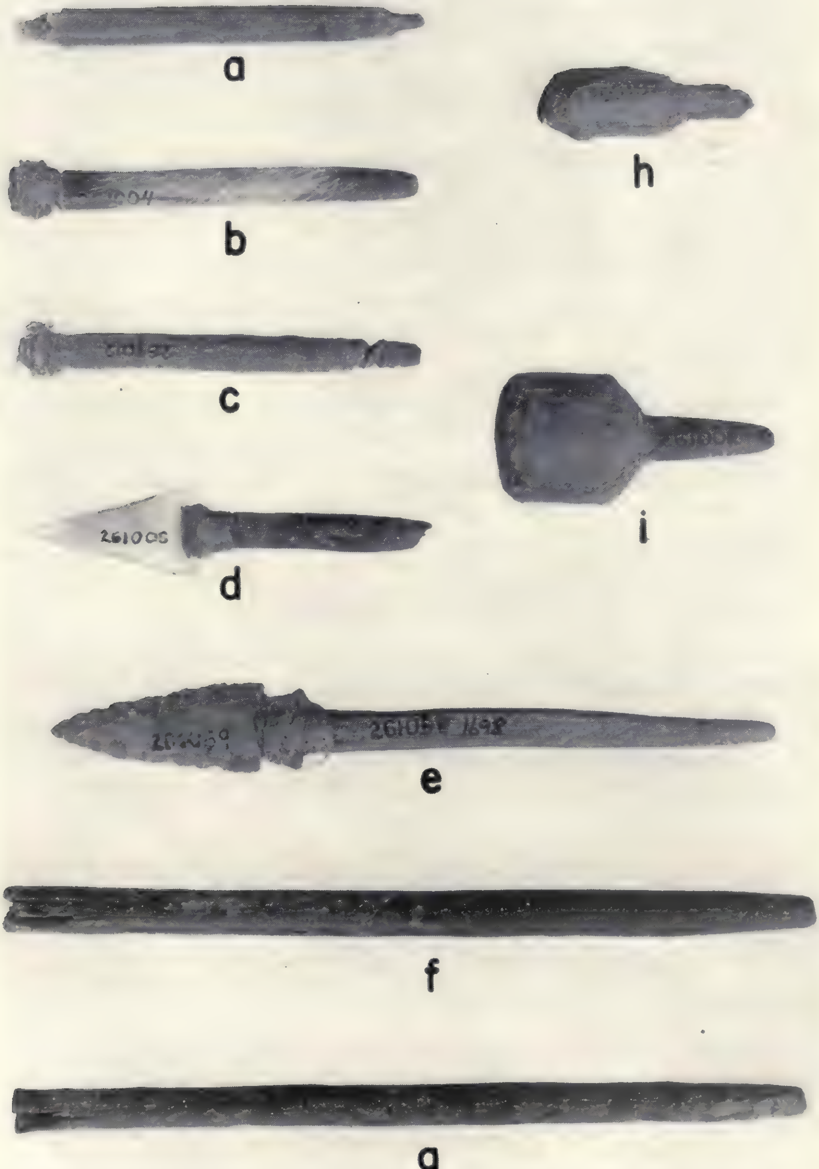

a
h
b
c
i
261005
d
e
f
g

FIG. 136. Atlatl dart foreshafts: *a–g*, slotted; *h*, *i*, bunts. Length of *g*, 11 cm.

Dimensions.—Length, 4.4–52.7 cm. (fragments); diameter, 0.8–0.9 cm.; diameter at cup, 0.7 cm.; cup diameter, 0.3–0.5 cm.; cup depth, 0.3–0.6 cm.

Atlatl Dart Foreshafts

SLOTTED (FIGS. 136, *a–g*, 137, *e*)

Technique.—Short sections of straight sticks used; bark peeled off; longitudinal and spiral scratches on the smoothed surfaces; spiral scratches on tapered proximal end.

Shape.—Rectangular slot in distal end; shafts round, oval or rectangular in cross section; shaft tapered at proximal end to fit mainshaft socket.

Projectile Points.—Four specimens with chipped stone projectile points or fragments held in slots with sinew bindings.

Special Features.—One specimen with deep, screw-threadlike spiral grooves on proximal end; one specimen with tenon tang on proximal end.

Decoration.—None.

Material.—Mountain mahogany (*Cercocarpus* sp.).

Occurrence by Phases, Tularosa Cave.—Georgetown, 3; San Francisco, 2; San Francisco-through-Tularosa, 3.

Dimensions.—Length, 10.4, 5.9, 9.9, 13.3, 10.1, 10.4, 20.7, 20.3 cm.; diameter, 1.2, 0.9, 0.8, 2.2 x 1.2, 1.0, 1.0, 1.2, 1.0 cm.; slot width, 0.3–0.4 cm.; slot depth, 1.0–1.5 cm.

POINTED (FIG. 137, *f*)

Technique.—Roughly worked into shape; little care in smoothing surfaces.

Shape.—Distal end tapering to point; proximal end rounded.

Material.—Mountain mahogany (*Cercocarpus* sp.).

Occurrence by Phase, Tularosa Cave.—Pre-Pottery, 2.

Dimensions.—Length, 16.5, 13.0 cm.; diameter, 1.0 cm.

BLUNT BURRED POINT (FIG. 137, *g*, *h*)

Technique.—Same as slotted foreshafts except that distal end is cut off bluntly, leaving burr of wood fiber.

Shape.—Proximal end tapering to fit mainshaft socket; distal end blunted; oval to round in cross section.

Decorations.—None.

Material.—Mountain mahogany (*Cercocarpus* sp.).

Occurrence by Phases, Tularosa Cave.—Pre-Pottery, 2; Pine Lawn, 5; Pine Lawn-through-Georgetown, 1; Georgetown, 2; San Francisco, 2; San Francisco-through-Tularosa, 1.

Dimensions.—Length, 6.2–11.0 cm.; diameter, 1.0 cm.

BURRED POINT, BARK-COVERED SHAFT

Technique.—Same as above except that bark is not peeled from shaft between distal and proximal ends.

Shape.—Proximal end tapering and rounded; distal end blunt and burred.

Decorations.—None, except bark remains.

Material.—Mountain mahogany (*Cercocarpus* sp.).

Occurrence by Phases, Tularosa Cave.—Pre-Pottery, 1; Pine Lawn, 2; Georgetown, 1.

Dimensions.—Length, 7.5 cm.; diameter, 1.0 cm.

PROXIMAL END FRAGMENTS

Technique.—Same as on slotted foreshaft proximal ends.

Shape.—Tapered, rounded proximal end; shaft is cut or broken off, leaving splintered end.

Occurrence by Phases, Tularosa Cave.—Pre-Pottery, 3; Pine Lawn, 2; Georgetown, 1; San Francisco, 2; San Francisco-through-Tularosa, 2.

Occurrence by Phase, Cordova Cave.—Pre-Pottery, 3.

FORESHAFT DISCARDS (FIG. 137, *a*, *b*)

Technique.—Sections of small branches; bark intact except where woodworking marks show; cutting, breaking, scraping marks on worked surfaces.

Shape.—Rectangular tenon protruding from one end; tenon removed from slot in manufacture of foreshaft.

Special Features.—One specimen wrapped with a twisted fiber cord (Fig. 137, *a*).

Material.—Mountain mahogany (*Cercocarpus* sp.).

Occurrence by Phases, Tularosa Cave.—Pre-Pottery, 3; Pine Lawn, 2; Georgetown, 3; San Francisco, 1 (cord wrapping); San Francisco-through-Tularosa, 1; unplaced, 1.

Occurrence by Phase, Cordova Cave.—Late, 1.

Dimensions.—Length, 10.0–20.0 cm.; diameter, 1.0–1.5 cm.; tenon length, 1.0–1.3 cm.; tenon width, 0.8–1.0 cm.; tenon thickness, 0.2–0.3 cm.

FORESHAFT BLANKS (FIG. 137, *c*, *d*)

Technique.—Sections of branches; bark peeled off; cutting, breaking, scraping methods used.

Shape.—T-shaped incisions on opposite sides at end; tenon is removed, completely worked blank becomes a foreshaft and section with tenon is discarded.

Special Features.—One specimen with T-shaped incisions at each end; one specimen with slot at one end and tenon on the other.

Material.—Mountain mahogany (*Cercocarpus* sp.).

Occurrence by Phases, Tularosa Cave.—San Francisco, 1 (slots at each end); San Francisco-through-Tularosa, 1 (slot and tenon).

Dimensions.—Length, 14.0, 26.5 cm.; diameter, 1.2 cm.; slot width, 0.3 cm.; slot length, 1.3 cm.

DART BUNTS (FIG. 136, *h*, *i*)

Technique.—Stick with large diameter; bark peeled; one end smoothed; tang whittled at other end and then shaped and smoothed.

Shape.—Cylindrical bunt head with slightly convex distal surface; tapers sharply at proximal end to form a central tang of greatly reduced diameter; spiraling scratches on tang.

Material.—Mountain mahogany (*Cercocarpus* sp.).

Occurrence by Phases, Tularosa Cave.—Pre-Pottery, 1; Pine Lawn, 1; Georgetown, 1; San Francisco, 1.

Occurrence by Phase, Cordova Cave.—Plain Ware, 2.

Dimensions.—Length, 3.9–7.1 cm. (average, 5.3 cm.); diameter, 1.2–3.1 cm. (average, 2.0 cm.); tang length, 1.8–2.9 cm. (average, 2.1 cm.); tang diameter, 0.8–1.0 cm. (average, 0.9 cm.).

Bows (Fig. 138, a, b)

Technique.—Heavy branches used; bark removed; cut to shape and smoothed or polished.

Shape.—Both bows plano-convex in cross section, tapering toward the tips. Specimen from Tularosa Cave has nocks at the tip and is carved to a permanent bend with the convex side (belly) presenting

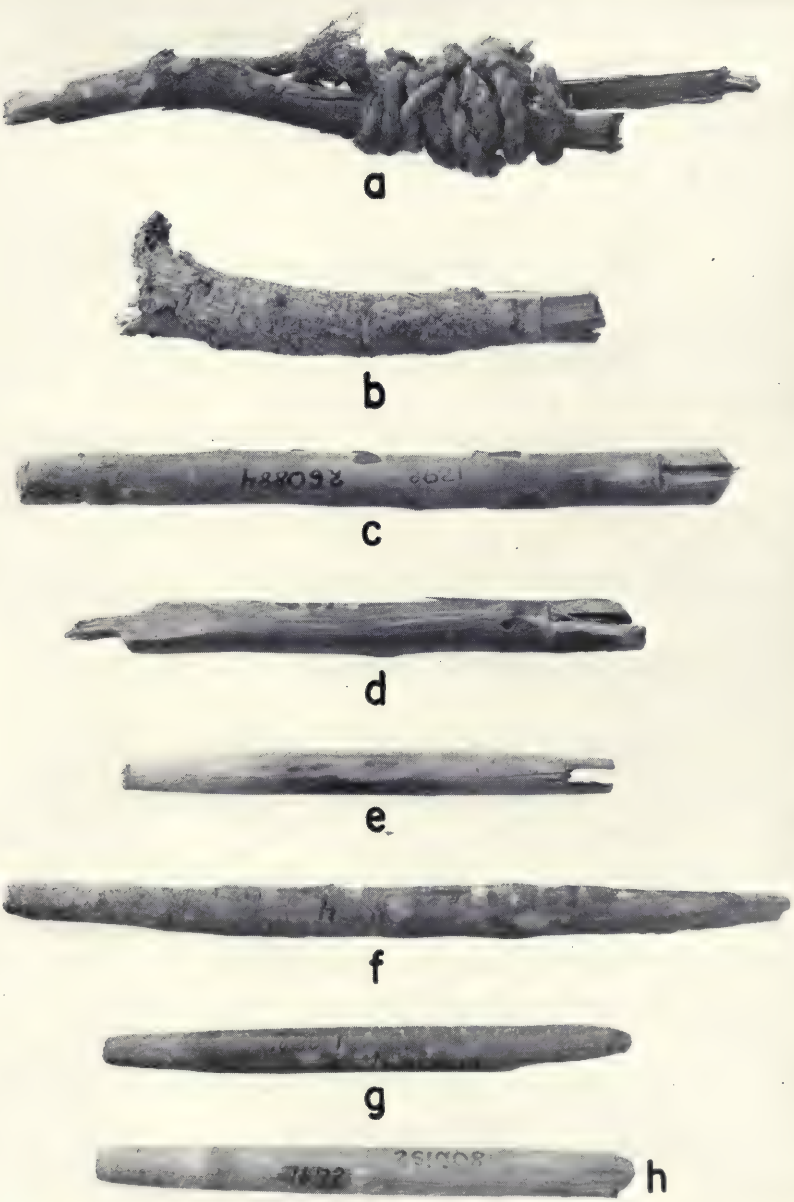


FIG. 137. Atlatl dart foreshafts, blanks and discards: *a*, *b*, discards; *c*, *d*, blanks; *e*, slotted; *f*, pointed; *g*, *h*, blunt burred point. Length of *f*, 16.5 cm.

a smooth curve, while the flat side (outer) is a discontinuous curve made up of planar segments 7.0 and 13.0 cm. long; specimen is polished but undecorated. Specimen from Cordova Cave has no nocks, does not have a permanent curve, and is smoothed but not polished. Band of sinew binding marks 10.0 cm. wide indicates position of hand grip(?). Cordova Cave bow consists of four fragments.

Decoration.—Specimen from Cordova Cave has two sets of four encircling bands (sinew binding marks) 0.3 cm. wide, 0.5 cm. apart, 5.0 cm. above top of hand grip binding marks. The two sets are 10.0 cm. apart.

Material.—Tularosa Cave specimen, oak (*Quercus* sp.); Cordova Cave specimen, soft wood, probably Juniper.

Occurrence by Phase, Tularosa Cave.—Reserve-through-Tularosa, 1.

Occurrence by Phase, Cordova Cave.—Late, 2.

Dimensions.—Length, 51.0, 56.0 cm. (fragments); width, 1.1–2.2 cm. (2.9 tapers to 1.0 cm.); thickness, 1.1–2.0 cm. (2.4 tapers to 1.0 cm.).

Arrows (Figs. 138–140)

All arrows are compound, consisting of a reed mainshaft and a wooden foreshaft.

COMPLETE COMPOUND ARROWS (FIG. 138, *c*, *d*)

Occurrence by Phases, Tularosa Cave.—San Francisco, 1; Reserve-through-Tularosa, 2 (one decorated foreshaft, one decorated mainshaft).

Dimensions.—Length, 59.0, 89.0, 67.0 cm.; length of mainshaft, 50.5, 62.0, 55.5 cm.; diameter of mainshaft, 0.8 cm.; length of foreshaft (excluding tang), 8.5, 27.0, 11.5 cm.; diameter of foreshaft, 0.6 cm.

MAINSHAFTS

Technique.—Made of reed; surfaces not smoothed (nodes remain); ends cut off squarely.

Shape.—Straight shaft; wooden plug inserted into proximal end and U- or V-shaped nocks cut into both reed and plug (when the plug is not used the nock is cut above a node in the reed shaft); sinew bindings used as reinforcement below the nock; distal end cut off squarely at right angles to the long axis of the shaft; sinew binding to hold foreshaft in place and to prevent mainshaft splitting.

Fletching.—Three feathers attached to mainshaft slightly below nock by means of sinew bindings at each end of quill; feathers trimmed in both width and length; feathers run parallel with shaft (do not spiral).

Decoration.—Painted decoration; confined to area around nock or under feathers; painting on or under sinew bindings; one specimen with black, parallel zigzag line decoration, eight with red bands, ten with black bands, two with alternating red and black bands.

Material.—Reed (*Phragmites communis*).

Dimensions.—All mainshafts fragmentary. Diameter, 0.6–1.0 cm. (average, 0.8 cm.); distance of feathers from proximal end of shaft, 0.3–3.3 cm. (average, 1.8 cm.); distance between feather bindings, 3.0–9.3 cm. (average, 6.9 cm.); over-all feather length, 6.0–12.2 cm. (average, 8.8 cm.).

PROXIMAL END FRAGMENTS (FIG. 139)

V-shaped nock with nock plug:

Occurrence by Phases, Tularosa Cave.—Pre-Pottery, 1; Pine Lawn, 1; San Francisco, 1; San Francisco-through-Tularosa, 8; surface, 1; unplaced, 1.

Occurrence by Phase, Cordova Cave.—Plain Ware, 1.

V-shaped nock with nock at node:

Occurrence by Phases, Tularosa Cave.—Georgetown, 1; San Francisco, 1; San Francisco-through-Tularosa, 4.

U-shaped nock with nock plug:

Occurrence by Phases, Tularosa Cave.—San Francisco, 1; San Francisco-through-Tularosa, 6; Reserve-through-Tularosa, 1.

Occurrence by Phase, Cordova Cave.—Late, 5 (3 painted).

U-shaped nock with nock at node:

Occurrence by Phases, Tularosa Cave.—Pine Lawn, 1; San Francisco, 3; San Francisco-through-Tularosa, 3.

Nocks not intact:

Occurrence by Phases, Tularosa Cave.—San Francisco, 2; San Francisco-through-Tularosa, 2; Reserve-through-Tularosa, 2.

Occurrence by Phase, Cordova Cave.—Late, 4.

DISTAL END FRAGMENTS (FIG. 140, *a*, *b*)

Occurrence by Phases, Tularosa Cave.—Georgetown, 1; San Francisco, 2 (1 with foreshaft in place); San Francisco-through-

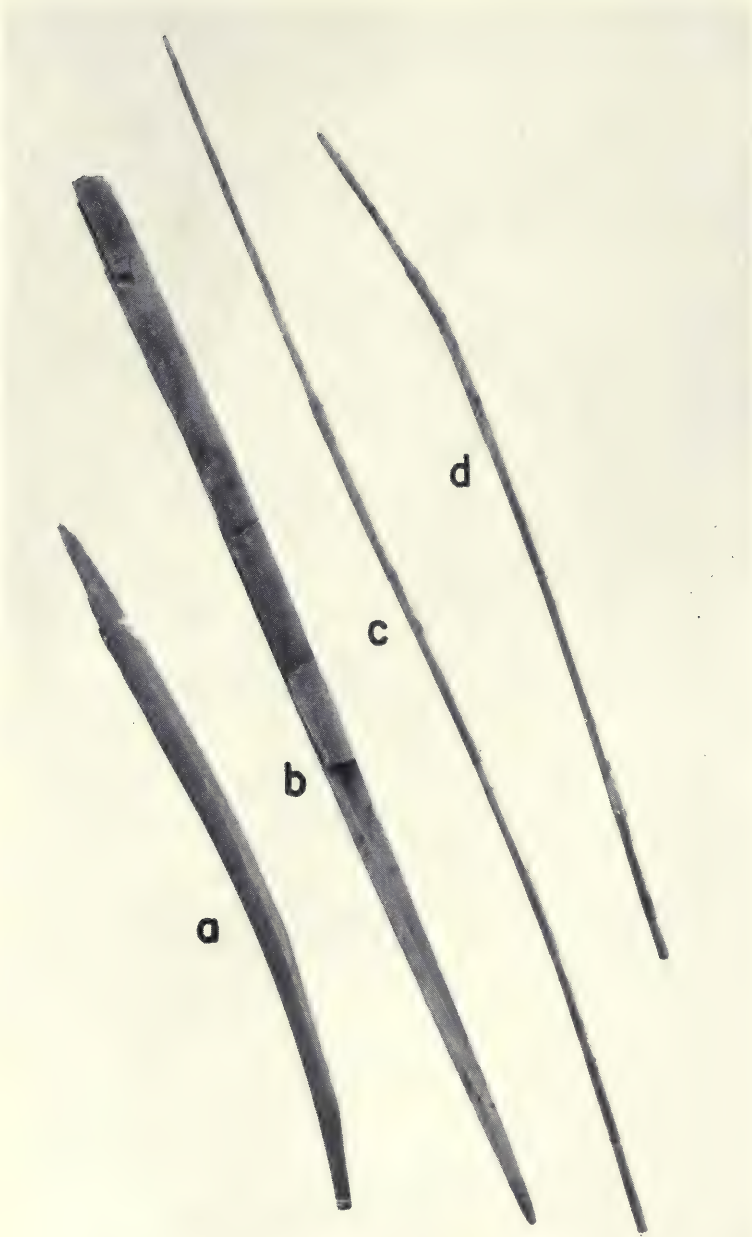


FIG. 138. Fragments of bows and complete arrows: *a*, bow, Tularosa Cave; *b*, bow, Cordova Cave; *c*, *d*, complete arrows, Tularosa Cave. Length of *c*, 89.0 cm.

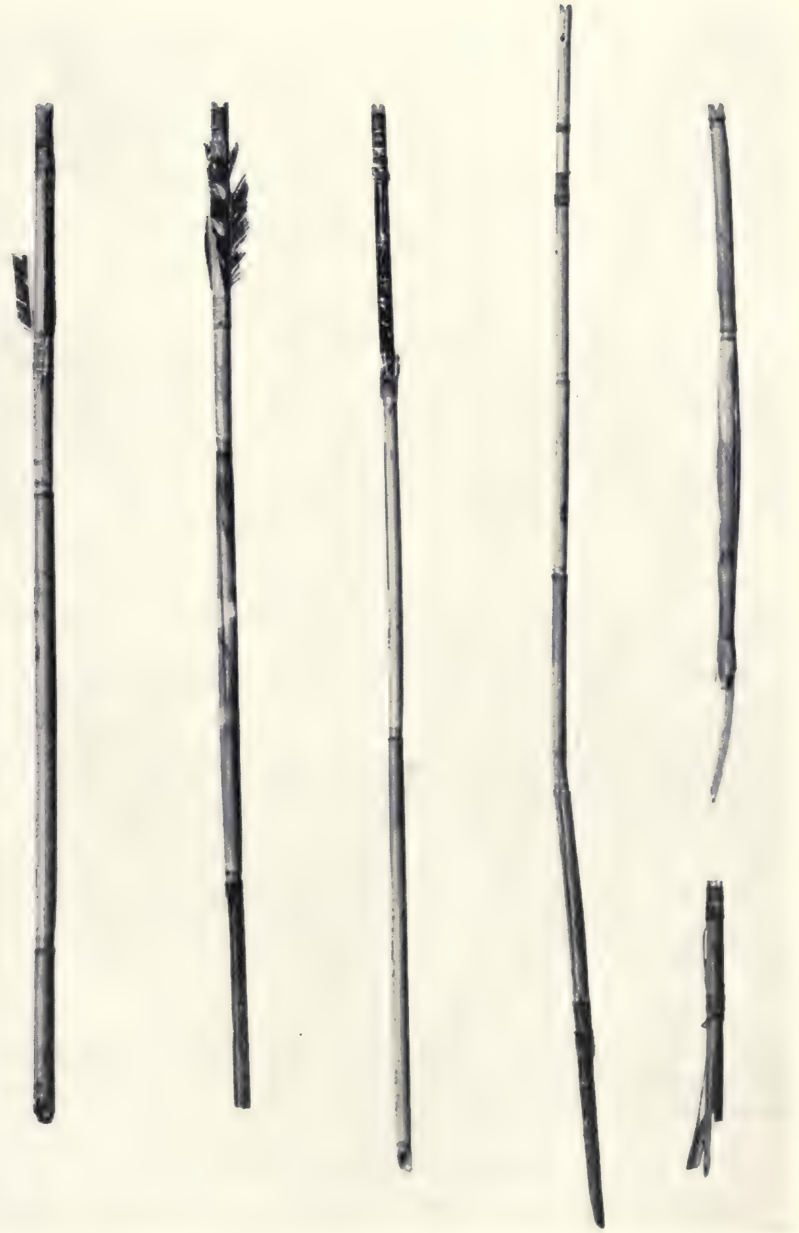


FIG. 139. Fragments of proximal end of arrow mainshafts. Length of longest specimen, 59.0 cm.

Tularosa, 15 (9 with foreshafts in place; 5 foreshafts painted red, 1 foreshaft with three red stripes); Reserve-through-Tularosa, 2 (foreshafts in place); unplaced, 1 (foreshaft in place).

Occurrence by Phase, Cordova Cave.—Late, 7 (foreshafts in place; foreshafts, 1 tapered tang, 1 shouldered tang, 1 plain point distal end; others fragmentary).

Note: Foreshafts listed here are *not* included in foreshaft tabulation.

FORESHAFTS (FIG. 140)

Technique.—Straight, slender sticks; bark peeled off; carved to shape and smoothed.

Shape.—Taper towards distal end; distal ends plain pointed, slotted, or broken and re-sharpened; proximal end has tapered or shouldered tang; slotted distal end has V-shaped notch for stone projectile point; no stone points in place, but sinew bindings remain around slot.

Decoration.—Decorated specimens painted red all over; distal tip and tang left unpainted; one specimen with three longitudinal red stripes; most foreshafts undecorated.

Material.—Willow (*Salix* sp.); mountain mahogany (*Cercocarpus* sp.).

Dimensions.—Length, 12.6–31.7 cm. (average, 20.8 cm.); diameter at base above tang, 0.5–0.8 cm. (average, 0.6 cm.); slot width, 0.2 cm.; slot depth, 0.5 cm.

SLOTTED DISTAL END (FIG. 140, *c*)

Occurrence by Phases, Tularosa Cave.—San Francisco, 1 (painted red; fragment); San Francisco-through-Tularosa, 1 (painted red; shouldered tang).

SHOULDERED TANG (FIG. 140, *c–g*)

Occurrence by Phases, Tularosa Cave.—Georgetown, 1 (painted red); San Francisco, 2; San Francisco-through-Tularosa, 2 (1 painted red); Reserve-through-Tularosa, 2.

TAPERED TANG (FIG. 140, *h*, *i*)

Occurrence by Phases, Tularosa Cave.—Georgetown, 2; San Francisco, 5 (2 painted red); San Francisco-through-Tularosa, 7 (1 painted red; 1 with pitch on tang); Reserve-through-Tularosa, 2 (1 painted red); unplaced, 2.

Occurrence by Phase, Cordova Cave.—Late, 1 (pitch on tang).

FORESHAFT FRAGMENTS

Occurrence by Phases, Tularosa Cave.—San Francisco, 1; San Francisco-through-Tularosa, 2 (1 painted red).

Occurrence by Phase, Cordova Cave.—Late, 2 (1 plain pointed, painted red except at tip).

Digging Sticks

FLAT HANDLE AND BLADE (FIG. 141, *e*)

Technique.—Natural shape of wood retained; bark peeled off; distal end polished by use.

Shape.—Handle and blade of single flat board; distal end a blunt rounded point.

Occurrence by Phase, Tularosa Cave.—Pre-Pottery, 2.

Dimensions.—Length, 37.0, 26.0 cm. (fragments); width, 4.0, 2.5 cm.; thickness, 1.5, 1.3 cm.

ROUGH POINT (FIG. 141, *d*)

Technique.—Small diameter, straight stick; bark peeled off; point on distal end produced by splitting off a portion of the stick; point polished by use.

Shape.—Cylindrical shaft with rough rounded point on one end.

Occurrence by Phase, Tularosa Cave.—Georgetown, 2.

Dimensions.—Length, 36.0 cm. (longest fragment); diameter, 1.4 cm.

SMOOTH POINT (FIGS. 141, *c*, 142, RIGHT)

Technique.—Same as above, except that point is smoothed and fire-hardened and polished by use.

Shape.—Cylindrical shaft smoothly tapering to rounded point.

Decoration.—Specimen from Cordova Cave has five longitudinal grooves running entire length of specimen and a groove encircling the handle 1.2 cm. from the proximal end.

Occurrence by Phases, Tularosa Cave.—Pre-Pottery, 1; San Francisco, 2.

Occurrence by Phases, Cordova Cave.—Pre-Pottery, 1; Late, 1 (four fragments of one specimen; not complete).

Dimensions.—Length, 25.5, 91.0+? cm. (fragments); diameter, 1.7 cm.

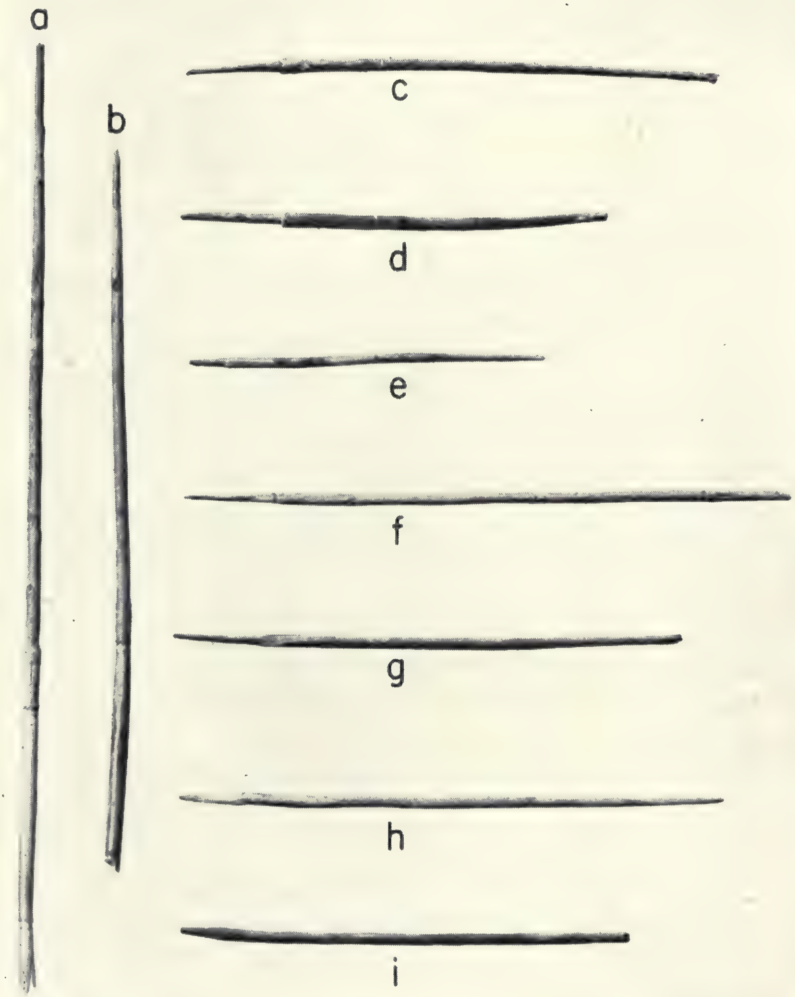


FIG. 140. Arrow foreshafts: *a*, *b*, mounted in mainshafts; *c*, slotted distal end; *c–g*, shouldered tang; *h*, *i*, tapered tang. Length of *a*, 27.8 cm.

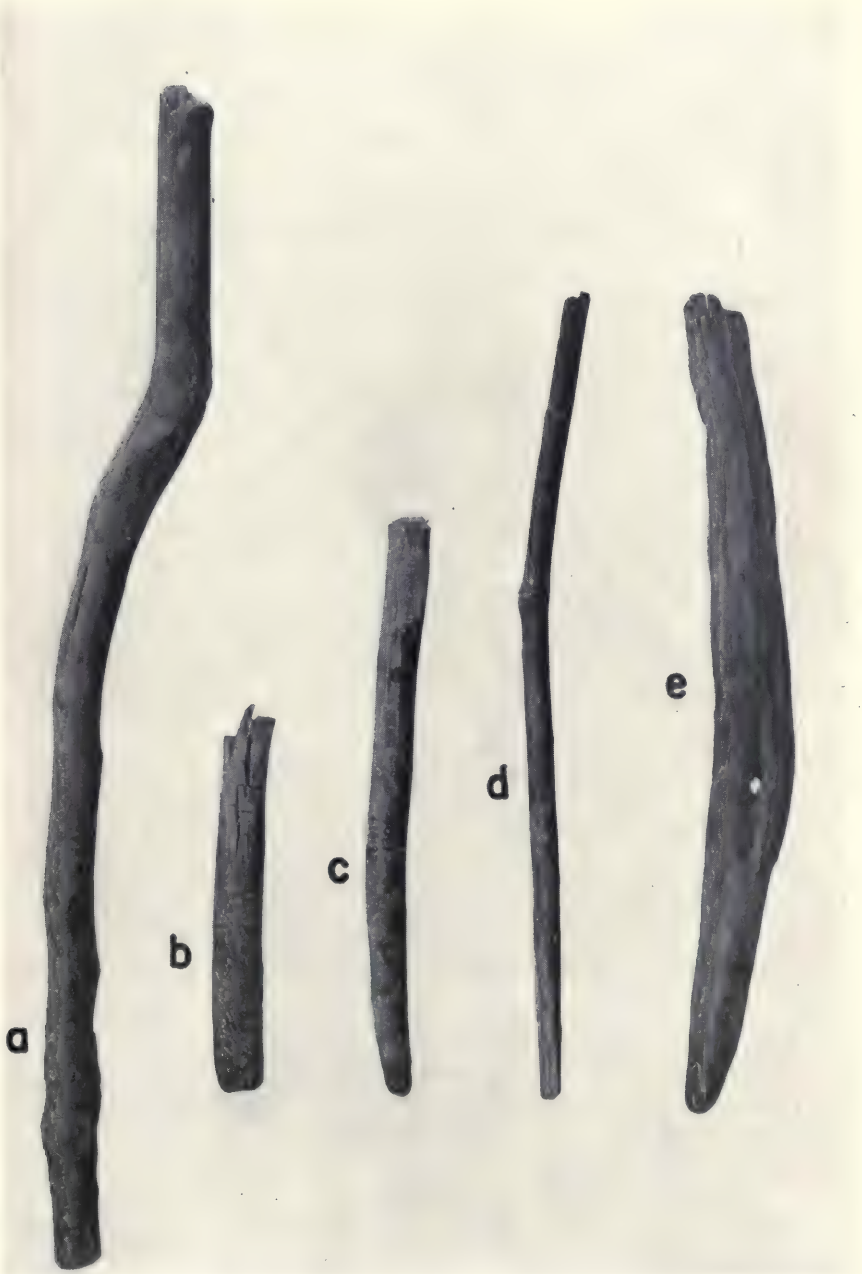


FIG. 141. Digging sticks: *a*, handle; *b*, flat blade; *c*, smooth-pointed; *d*, rough-pointed; *e*, flat handle and blade. Length of *b*, 17.0 cm.

FLAT BLADE (FIG. 141, *b*)

Technique.—Same as above except that blade is carved to shape and smoothed; nicks on blade surface are woodworking marks or resulted from use of the specimen.

Shape.—Cylindrical shaft; blade wedge-shaped in longitudinal cross section, rectangular in outline, edges rounded; blade slightly curved.

Occurrence by Phase, Tularosa Cave.—San Francisco-through-Tularosa, 2 (fragments).

Dimensions.—Length, 17.0 cm. (longer fragment); diameter, 2.2 cm.; blade length, 9.0 cm.; blade width, 2.2 cm.; blade thickness at tip, 0.8 cm.

HANDLE (FIG. 141, *a*)

Technique.—Heavy stick; bark remains on shaft; end peeled and polished, cut off at right angles to long axis of shaft.

Shape.—Straight shaft terminating in blunt handle.

Occurrence by Phase, Tularosa Cave.—Reserve-through-Tularosa, 1.

Material.—Mountain mahogany (*Cercocarpus* sp.).

Dimensions.—Length, 54.0 cm. (fragment); diameter, 2.5 cm.

Bark and Wooden Trowels

WOODEN TROWELS, WEDGE-SHAPED (FIG. 143, *a*)

Technique.—Hardwood board; thick end cut off by whittling on opposite sides and then breaking the central fibers; nicks and scratches on flat surfaces caused from working to shape.

Shape.—Rectangular in outline; wedge-shaped in longitudinal cross section.

Material.—Mountain mahogany (*Cercocarpus* sp.).

Occurrence by Phase, Tularosa Cave.—Pre-Pottery, 2.

Dimensions.—Length, 12.9, 7.5 cm. (latter fragmentary); width, 11.5, 9.0 cm.; thickness, 1.9, 1.5 cm. (taper to thin edge).

WOODEN TROWELS, CONCAVE-CONVEX (FIG. 142, LEFT)

Technique.—Naturally curved section of tree or branch used; bark removed.

Shape.—Quadrangular in outline; concave-convex with diagonal corners offset, that is, one high and one low corner on each end; corners and edges rounded and roughened by use.

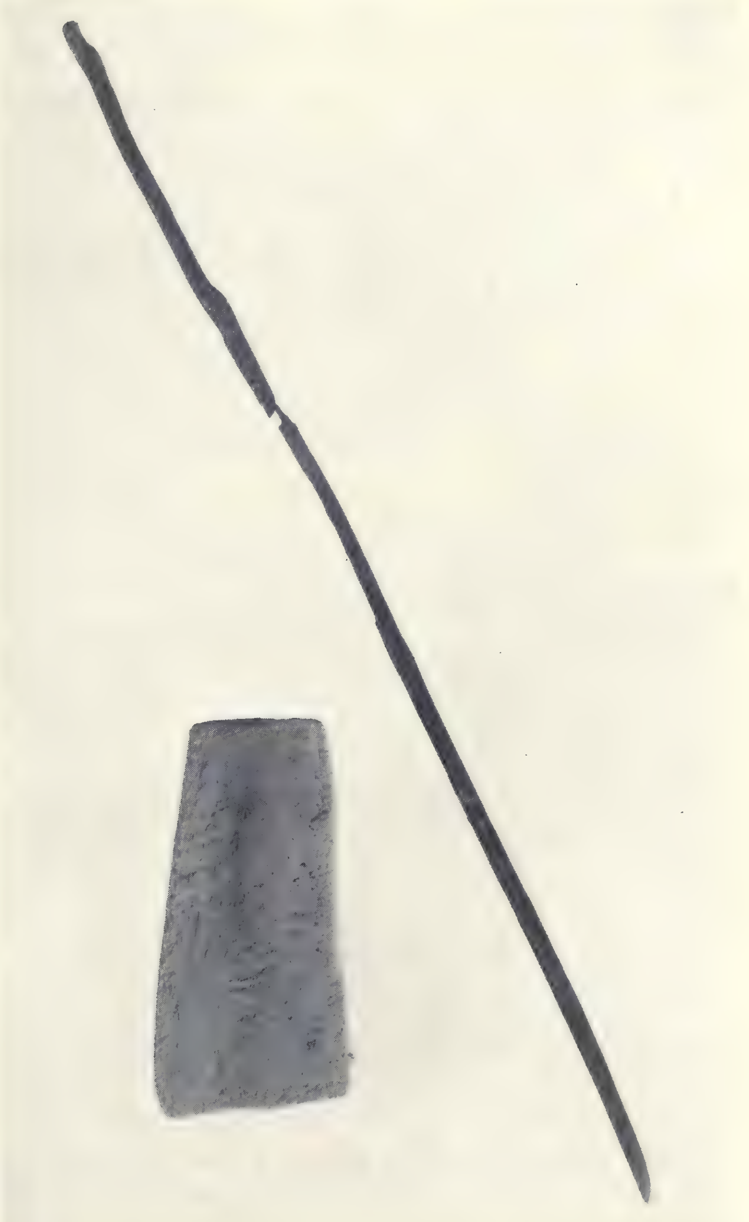


FIG. 142. Wooden trowel, concave-convex (left); digging stick, smooth-pointed (right). Length of trowel, 27.2 cm.

Material.—Mountain mahogany (*Cercocarpus* sp.).

Occurrence by Phase, Cordova Cave.—Plain Ware, 1.

Dimensions.—Length, 27.2 cm.; width, 10.5–13.8 cm.; thickness, 0.7–1.0 cm.

WOODEN SCOOP (FIG. 143, *c*)

Technique.—Hardwood board; surface and edges smoothed.

Shape.—Rectangular in outline; corners on one end rounded; concave-convex in both longitudinal and transverse cross section; concavity more pronounced at rounded end.

Material.—Oak (*Quercus* sp.).

Occurrence by Phase, Tularosa Cave.—Georgetown, 1.

Occurrence by Phase, Cordova Cave.—Pre-Pottery, 1 (fragment).

Dimensions.—Length, 16.5 cm.; width, 4.8 cm.; thickness, 0.9 cm.

BARK TROWELS (FIG. 143, *b*)

Technique.—Sections of bark with laminated structure; edges worn smooth.

Shape.—Roughly rectangular; two with narrow end.

Material.—Bark of Pine (*Pinus ponderosa*).

Occurrence by Phases, Tularosa Cave.—Pre-Pottery, 1; Pine Lawn-through-Georgetown 1; San Francisco, 1.

Occurrence by Phase, Cordova Cave.—Pre-Pottery, 2 (1 fragment).

Dimensions.—Length, 11.5, 16.3, 12.6, 10.0 cm.; width, 8.9, 9.2, 6.9, 6.5 cm.; thickness, 1.3, 1.0, 1.8, 0.5–1.5 cm.

Fire Drill Hearths

PLANO-CONVEX HEARTHS (FIG. 144, *c*, *d*)

Technique.—Pithy stick; split in two; bark removed.

Shape.—Plano-convex in cross section; socket with slot through wall set in flat side of hearth; socket has rounded bottom.

Material.—Flowering stalk of monocotyledon.

Occurrence by Phases, Tularosa Cave.—Pine Lawn, 1; Georgetown, 1.

Dimensions.—Length, 10.3, 6.9 cm. (fragments); width, 1.8, 1.7 cm.; thickness, 1.0, 1.1 cm.; socket diameter, 1.0, 1.1 cm.; socket depth, 0.5, 0.8 cm.

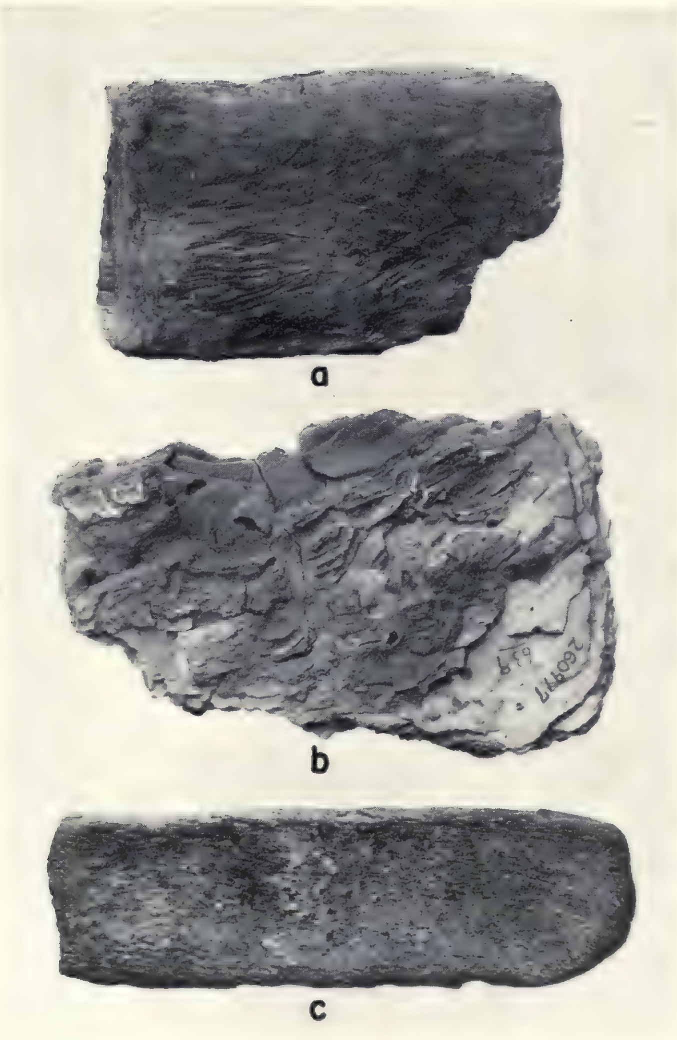


FIG. 143. Wooden trowel (*a*); bark trowel (*b*); wooden scoop (*c*). Length of *c*, 16.5 cm.

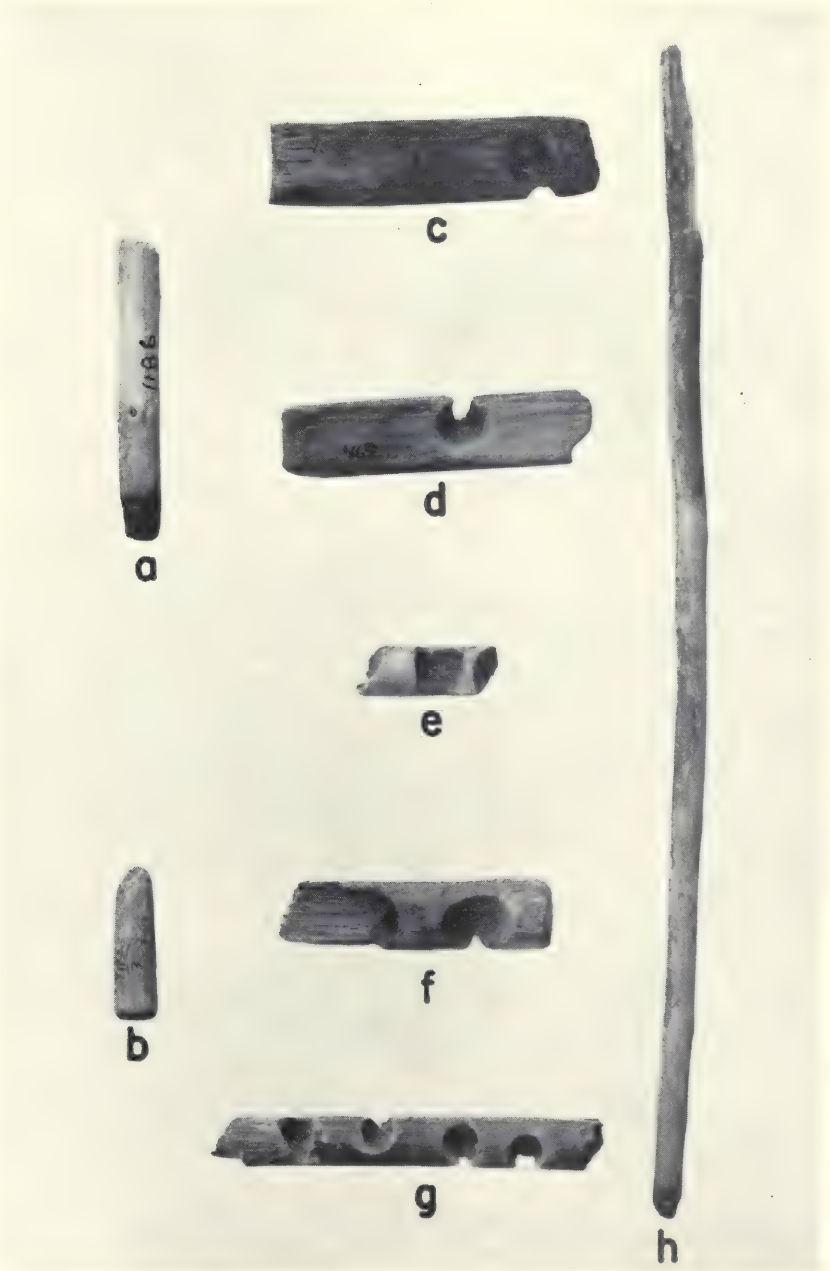


FIG. 144. Fire drills and fire drill hearths: *a*, *h*, simple fire drills; *b*, compound fire drill foreshaft; *c*, *d*, plano-convex hearths; *e–g*, cylindrical hearths. Length of *h*, 26.0 cm.

CYLINDRICAL HEARTHS (FIG. 144, *e–g*)

Technique.—Pithy stick; bark removed.

Shape.—Cylindrical in cross section. Tularosa Cave: several sockets set in a row along one side of the stick; sockets slotted, with rounded bottoms. Cordova Cave: fragments, broken through hearth socket at end of stick.

Material.—Flowering stalk of monocotyledon.

Occurrence by Phases, Tularosa Cave.—San Francisco, 1 (3 sockets); San Francisco-through-Tularosa, 2 (one with 2 sockets; one with 6 sockets).

Occurrence by Phases, Cordova Cave.—Pre-Pottery, 2; Plain Ware, 1; Late, 3.

Dimensions.—Length, 3.2–8.8 cm. (fragments); diameter, 1.1–1.5 cm.; socket diameter, 0.5–1.2 cm.; socket depth, 0.5–1.3 cm.

OVAL HEARTHS

Technique.—Pithy stick; bark removed.

Shape.—Straight sides; oval cross section; slotted socket.

Material.—Flowering stalk of monocotyledon.

Occurrence by Phase, Cordova Cave.—Plain Ware, 1.

Dimensions.—Width, 2.0 cm.; thickness, 0.7 cm.; socket diameter, 1.0 cm.; socket depth, 0.5 cm.; length, fragmentary.

Fire Drills (Fig. 144, a, b, h)

Technique.—Slender sticks; bark peeled off.

Shape.—Sticks with one end rounded and charred; charred end fits into socket in fire drill hearth.

Occurrence by Phases, Tularosa Cave.—Georgetown, 1; San Francisco, 2 (one is foreshaft of compound fire drill).

Dimensions.—Length, 26.0, 6.5, 3.4 cm. (fragments); diameter, 1.2, 1.0, 1.0 cm.

Wooden Spoon and Ladle

SPOON (FIG. 145, *e*)

Technique.—Carved from a single piece of hard wood; all surfaces smoothed and polished.

Shape.—Bowl oval in outline, hemispherical in transverse cross section, rounded on bottom; top edges of bowl scalloped; handle oval in cross section and broken.

Material.—Oak (*Quercus* sp.)?

Occurrence by Phase, Tularosa Cave.—San Francisco, 1.

Dimensions.—Length, 7.0 cm. (fragment); handle diameter, 1.6 cm.; bowl length, 3.2 cm.; bowl width, 2.9 cm.; bowl depth, 1.1 cm.

LADLE (FIG. 145, *b*)

Technique.—Same as above, but softer wood; not polished.

Shape.—Bowl oval in outline; hemispherical in transverse cross section; bottom of bowl angular in longitudinal cross section; top edges of bowl flat and in same plane as top of handle; handle oval in cross section, broken on end.

Occurrence by Phase, Tularosa Cave.—San Francisco-through-Tularosa, 1.

Dimensions.—Length, 27.8 cm. (fragment); handle diameter, 2.7 cm.; bowl length, 9.4 cm.; bowl width, 6.8 cm.; bowl depth, 3.4 cm.

Wooden Knife Handles (Fig. 146, c)

Technique.—Bark removed; surfaces smoothed.

Shape.—Straight wooden handle with ends cut off squarely at right angles to long axis; one end smoothed; opposite end notched for insertion of stone blade; marks of sinew binding spiral around notch.

Occurrence by Phases, Cordova Cave.—Pre-Pottery, 1; Late, 1 (fragment).

Dimensions.—Length, 5.9, 11.2 cm.; diameter, 1.1, 1.1 cm.

Wooden Awls

SHOULDERED AWL (FIG. 145, *c*)

Technique.—Stick with bark removed; part of one end split off to form shoulder and awl point; surfaces smoothed but splitting marks not eradicated.

Shape.—Cylindrical handle; awl point tapers out of shoulder to a rounded tip.

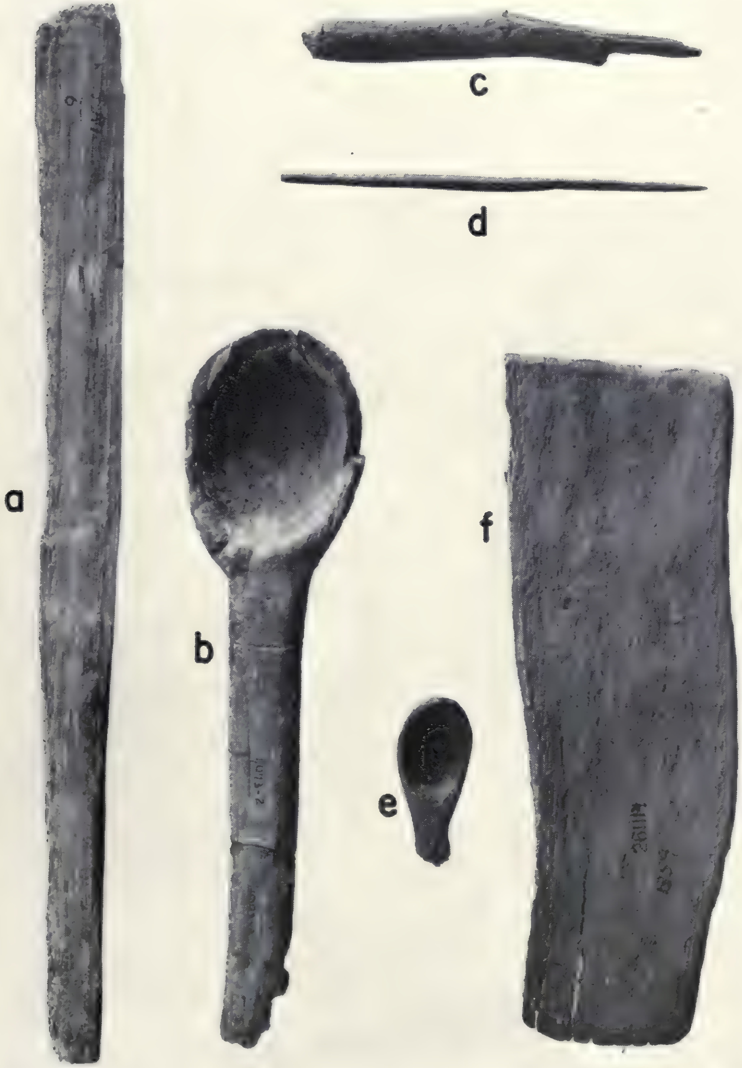


FIG. 145. Unfinished atlatl(?) (*a*); wooden ladle (*b*); shouldered wooden awl (*c*); straight wooden awl (*d*); wooden spoon (*e*); fragment of lap board(?) (*f*). Length of *b*, 27.8 cm.

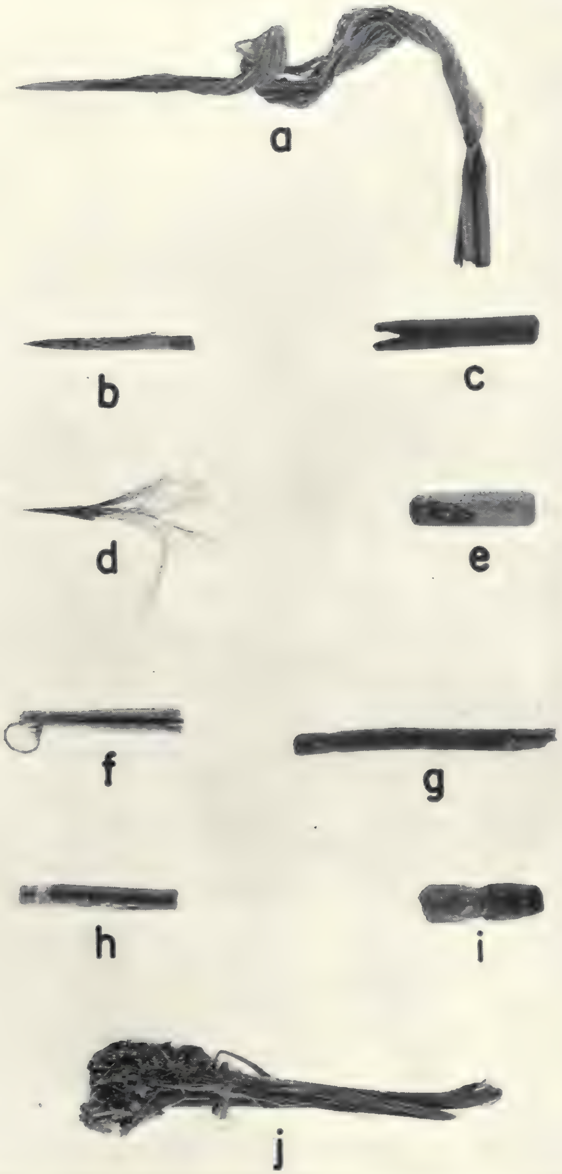


FIG. 146. Yucca leaf spine needles (*a*, *b*, *d*); wooden knife handle (*c*); tubular container (*e*); reed tube and cord (snares?) (*f*, *h*); fragment of hinged-stick snare (*g*); fragment of carved paho (*i*); glue brush (*j*). Length of *c*, 5.9 cm.

Occurrence by Phase, Tularosa Cave.—San Francisco-through-Tularosa, 1.

Dimensions.—Length, 16.0 cm.; diameter, 1.5 cm.; point length, 3.7 cm.; point diameter, 0.7 cm.

STRAIGHT AWL (FIG. 145, *d*)

Technique.—Slender, straight stick; surfaces smoothed and polished.

Shape.—One end rounded; shaft tapers to a point on opposite end.

Occurrence by Phase, Tularosa Cave.—Pine Lawn, 1.

Dimensions.—Length, 16.5 cm.; diameter, 0.5 cm.

Spindles (Fig. 147, b, c)

Technique.—Slender, straight twigs used; bark removed; ends polished.

Shape.—One specimen (shorter one) has one pointed end and one end blunt and flat-sided; two specimens pointed and polished on both ends; diameters of longer specimens approximate diameters of holes in spindle whorls.

Occurrence by Phase, Tularosa Cave.—Georgetown, 2.

Occurrence by Phase, Cordova Cave.—Late, 1.

Dimensions.—Length, 32.8, 59.6, 33.0 cm.; diameter, 0.6, 0.4, 0.3 cm.

Weaving Tool (Fig. 147, d)

Technique.—Straight stick; bark removed; surfaces polished.

Shape.—Ends of stick rounded; slot cut in each end; slots on axes 45 degrees opposed to one another.

Occurrence by Phase, Tularosa Cave.—Georgetown, 1.

Dimensions.—Length, 25.3 cm.; diameter, 0.4 cm.; slot width, 0.1 cm.; slot depth, 0.6 cm.

Snares

HINGED-STICK SNARE (FIG. 146, *g*)

Technique.—Bark removed.

Shape.—Encircling groove cut near one end of stick. Opposite end broken off; fragment.

Occurrence by Phase, Cordova Cave.—Late, 1.

Dimensions.—Diameter, 0.8 cm. Groove is 1.0 cm. from end (0.4 cm. wide; 0.1 cm. deep).

FORKED-STICK SNARE (FIG. 148, *b*)

Technique.—Forked ends of stick roughly broken; shaft end cut off smoothly; bark removed.

Shape.—Y-shaped forked stick; twisted fiber cord 45 cm. long tied to shaft just below fork; slip knot and noose in free end of cord.

Material.—Willow (*Salix* sp.).

Occurrence by Phase, Tularosa Cave.—Pine Lawn, 1.

Dimensions.—Length, 31.0 cm.; diameter, 1.3 cm.

Glue Brush (Fig. 146, j)

Technique.—Portion of yucca leaf bent to shape and tied.

Shape.—Leaf bent double and tied with fiber; wide portion used as glue brush tapers to narrow handle; mass of glue and fiber adhering to wide end.

Material.—Yucca leaf.

Occurrence by Phase, Cordova Cave.—Late, 1.

Dimensions.—Length, 15.0 cm.; width, 3.5 cm. (tapers to 1.0 cm.); thickness, 0.5 cm.

Pitch Container (Fig. 149, a)

Technique.—Made of two yucca leaves, bent to shape.

Shape.—One leaf bent to touch at ends, forming triangular cup; other leaf forms bottom, reinforces end, and loops over top to form a handle; triangular cup filled with resinous pitch.

Materials.—Yucca leaves; pine (*Pinus ponderosa*) pitch.

Occurrence by Phase, Tularosa Cave.—Georgetown, 1.

Dimensions.—Length, 10.4 cm.; width, 4.6 cm. (tapers to 2.1 cm.); thickness, 4.3 cm.

Stick and Cord (Snare Trigger?) (Fig. 149, e)

Technique.—Branched twig; bark left intact.

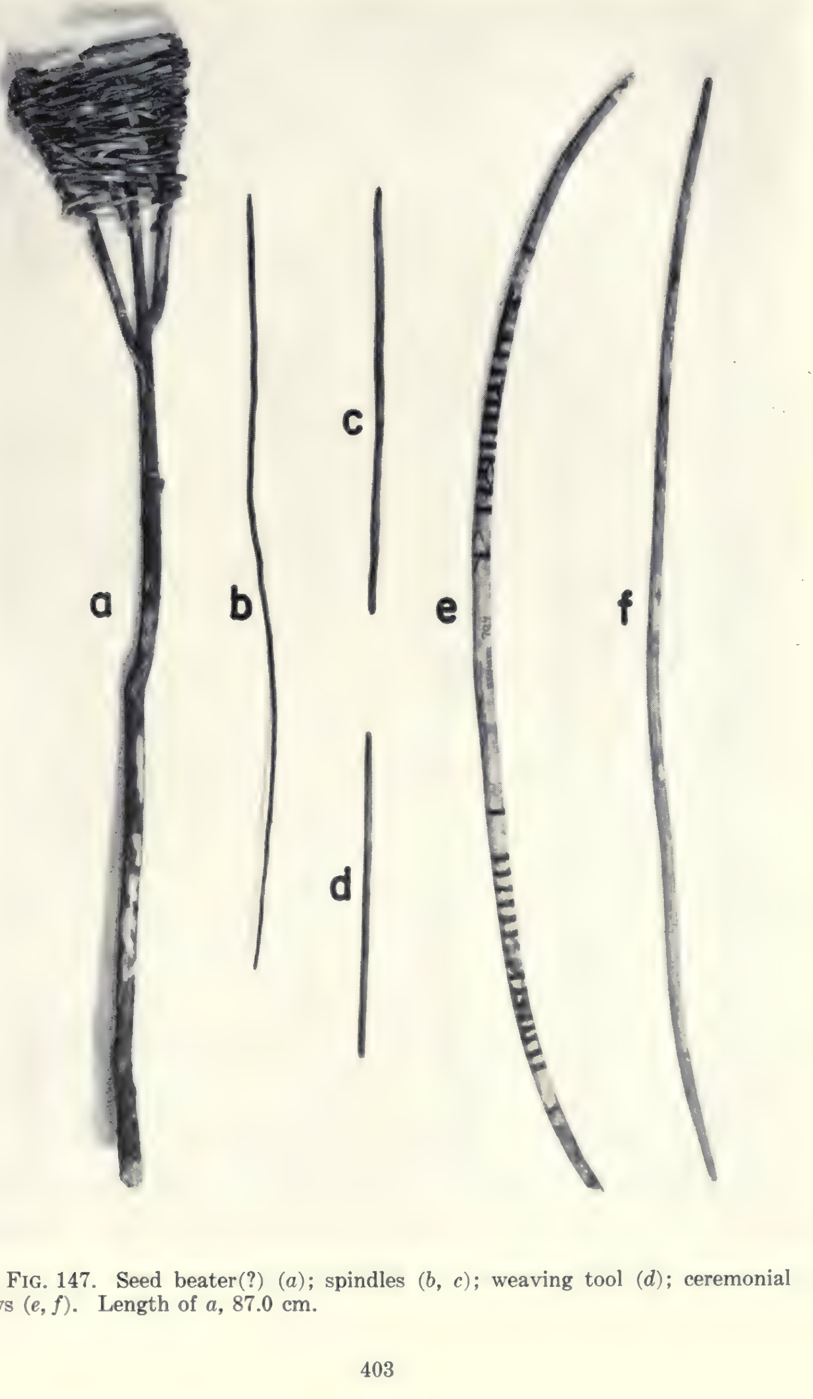


FIG. 147. Seed beater(?) (*a*); spindles (*b*, *c*); weaving tool (*d*); ceremonial bows (*e*, *f*). Length of *a*, 87.0 cm.

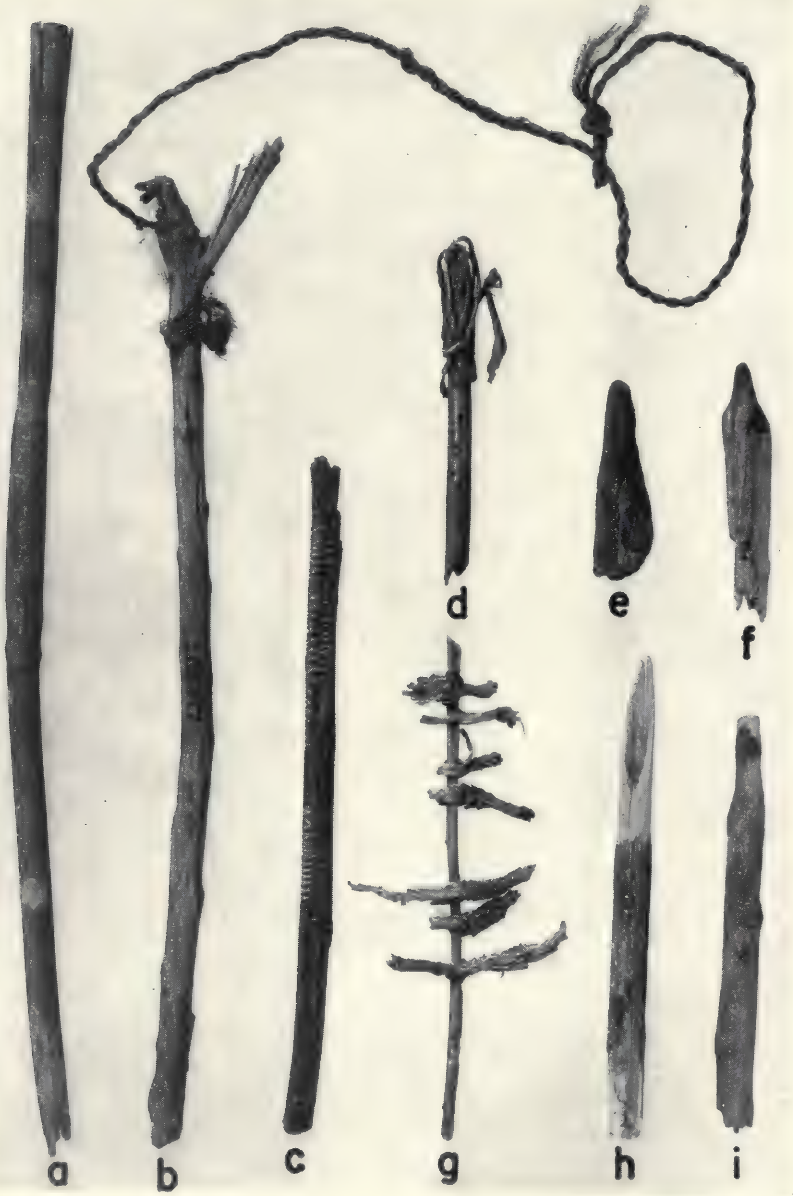


FIG. 148. Long reed tube (*a*); stick and snare (*b*); incised stick, scratched (*c*); fiber-capped reed (*d*); charred shouldered, pointed sticks (*e, f*); skewer (*g*); spatulas (*h, i*). Length of *a*, 42.0 cm.

Shape.—T-shaped; twisted fiber cord wrapped around T-joint; several strands of hair under knot; cord tied to stick at end of long shaft, and hangs loose between two knots; excess cord hangs free below second knot; end of cord knotted to prevent unraveling.

Occurrence by Phase, Tularosa Cave.—Georgetown, 1.

Dimensions.—Length, 6.3 cm.; diameter, 0.3 cm.; length of T bar, 1.3 cm.; length of excess cord, 13.0 cm.

Reed Tube and Cord (Snares?) (Fig. 146, f, h)

Technique.—Segments of pithy stick; whittled to length.

Shape.—Ends cut off squarely at right angles to long axis; three are hollow tubes, two are solid. An encircling groove is incised in the outer layer of the reed 0.5 cm. below one end. A 2-yarn hard fiber cord is tied around the groove. Free end of cord passes through tube and out opposite end, forming a noose above grooved end.

Material.—Reed (*Phragmites communis*) and hard fiber cord.

Occurrence by Phase, Cordova Cave.—Late, 5.

Dimensions.—Length, 7.7, 5.7, 4.5, 4.0, 4.2 cm.; diameter, 0.7 cm.

Split Stick Hooks

A. *Technique.*—Flexible stick; bark remaining intact; split in half; bent and tied in shape.

Shape.—One end of stick bent back on self; second, shorter piece of split stick inserted in loop, forming square knot that holds hook shape in end of stick.

Occurrence by Phase, Tularosa Cave.—San Francisco-through-Tularosa, 1.

Dimensions.—Length, 44.0 cm.; width, 1.1 cm.; thickness, 0.6 cm.; hook length, 8.0 cm.

B. *Technique.*—Stiff split stick; bark remains; bent to shape.

Shape.—Bent to form a hook at each end.

Occurrence by Phase, Tularosa Cave.—San Francisco-through-Tularosa, 1.

Dimensions.—Length, 16.2 cm.; width, 1.2 cm.; thickness, 0.4 cm.; length of hooks, 3.2, 3.5 cm.

Burred Pieces (Feather Carding Devices?) (Fig. 149, g, h)

Technique.—Large diameter sticks; bark removed; one end whittled to blunt point, one end shredded.

Shape.—Short section of wood with ball of shredded wood fiber at one end. Specimens have small fragments of feathers and feather down caught in the burred portion.

Material.—Oak (*Quercus* sp.).

Occurrence by Phases, Tularosa Cave.—Pre-Pottery, 1; Pine Lawn, 1; Georgetown, 1; San Francisco, 4.

Occurrence by Phase, Cordova Cave.—Plain Ware, 1.

Dimensions.—Length, 3.5–16.0 cm. (average, 8.5 cm.); diameter, 1.0–2.7 cm. (average, 1.6 cm.); size of burred portion, 7.0×3.5–1.5×1.0 cm.

Burred Wood Cylinders

Technique.—Straight sticks; bark removed.

Shape.—One end smoothed; opposite end has short, protruding, wood fibers; white feather down caught in splinters.

Remarks.—From same square and level as Pre-Pottery specimen above and possibly related to it.

Occurrence by Phase, Tularosa Cave.—Pre-Pottery, 1.

Occurrence by Phase, Cordova Cave.—Plain Ware, 1.

Dimensions.—Length, 6.0, 6.0 cm.; diameter, 1.5, 1.0 cm.

Tubular Container (Fig. 146, e)

Technique.—Bark removed, surfaces scraped smooth; ends cut off squarely at right angles to long axis.

Shape.—Pithy center removed, leaving one end of the tube closed and the other open.

Decoration.—None.

Occurrence by Phase, Cordova Cave.—Pre-Pottery, 1.

Dimensions.—Length, 4.3 cm.; diameter, 1.3 cm.; diameter of hole, 0.7 cm.; depth of hole, 2.2 cm.

Toggles(?) (Fig. 150, c, d)

Technique.—Straight sticks; bark remains intact; ends cut or broken off.

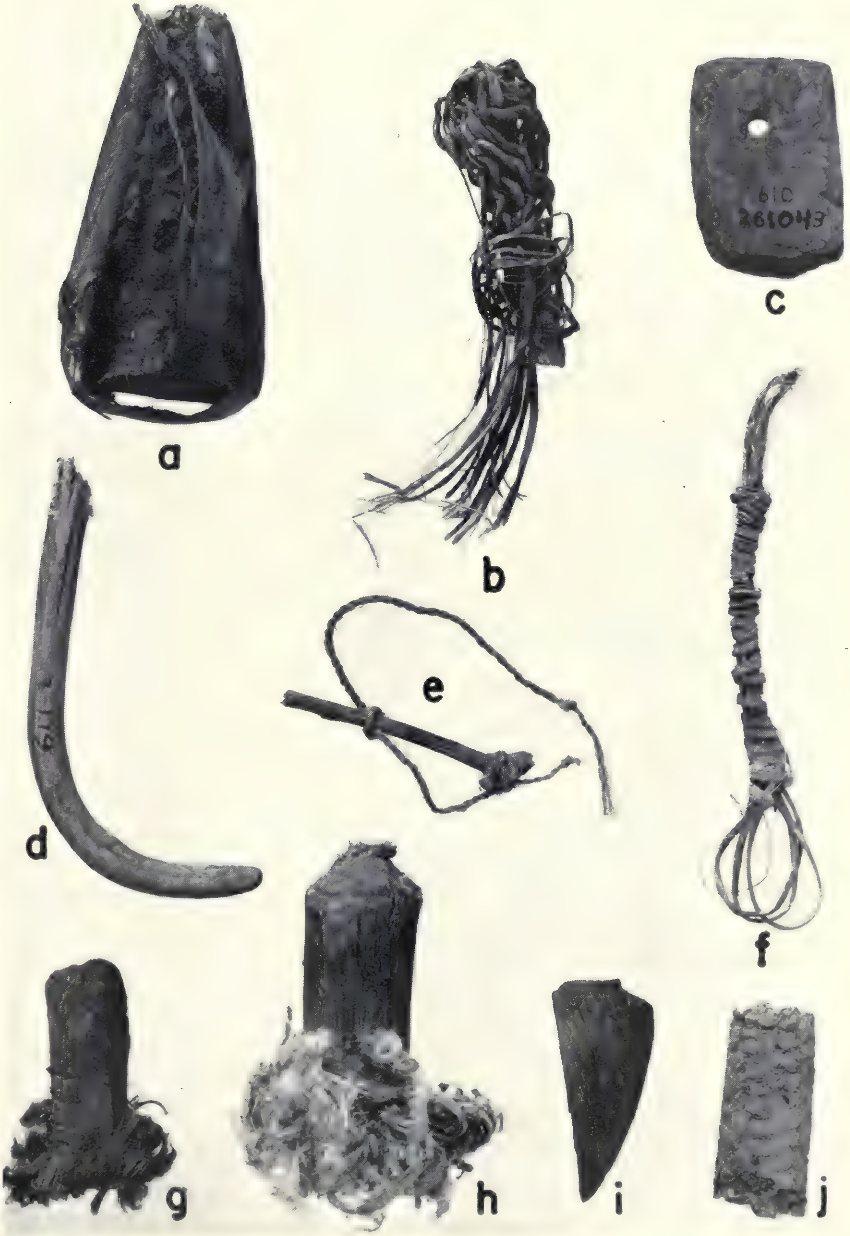

a
b
c
610
261043
d
e
f
g
h
i
j

FIG. 149. Pitch container (*a*); woven yucca on stick (*b*); bark pendant (*c*); crook fragment(?) (*d*); snare trigger(?) (*e*); fiber loop (*f*); burred pieces (*g*, *h*); carved pendant(?) (*i*); corn cob pottery smoother (*j*). Length of *j*, 5.5 cm.

Shape.—Twisted fiber cord wrapped one or two turns around center of stick and tied; excess cord hangs free.

Decoration.—Two specimens, one Georgetown and one San Francisco, with fine incising circumscribing stick in bark at 0.4 cm. intervals.

Occurrence by Phases, Tularosa Cave.—Pine Lawn, 1; Georgetown, 2; San Francisco, 1.

Dimensions.—Length, 8.3–19.3 cm. (average, 13.1 cm.); diameter, 0.7–1.1 cm. (average, 0.8 cm.); excess cord length, 2.0–20.0 cm.

Yucca Leaf Spine Needles (Fig. 146, a, b, d)

Technique.—Spine cut from leaf.

Shape.—Tapering, pointed; cut off at wide end; one with several fibers protruding from larger end, possibly for twining with cord to be sewn. One fragment, associated(?) with sandal, in which leaf is crushed, except for spine tip; possibly used for repairing sandal after which the spine tip is cut off and thrown away.

Material.—Yucca.

Occurrence by Phases, Cordova Cave.—Plain Ware, 1; Late, 6.

Dimensions.—Length, 2.7–7.6 cm.

Yucca Leaf Brush

Technique.—Segment of leaf, shredded.

Shape.—Flat portion of yucca leaf, shredded on one end, ends of fibers cut off evenly.

Material.—Yucca.

Occurrence by Phase, Cordova Cave.—Late, 1.

Dimensions.—Length, 6.3 cm.; width, 1.0 cm.; brush length, 2.5 cm.

Spatula-like Objects (Fig. 148, h, i)

CYLINDRICAL OBJECTS

Technique.—Reed-like pithy stick; bark peeled off around one end; carved blade.

Shape.—Blade formed by carving portion of one end to a point on side of cylinder; pith removed from center of blade.

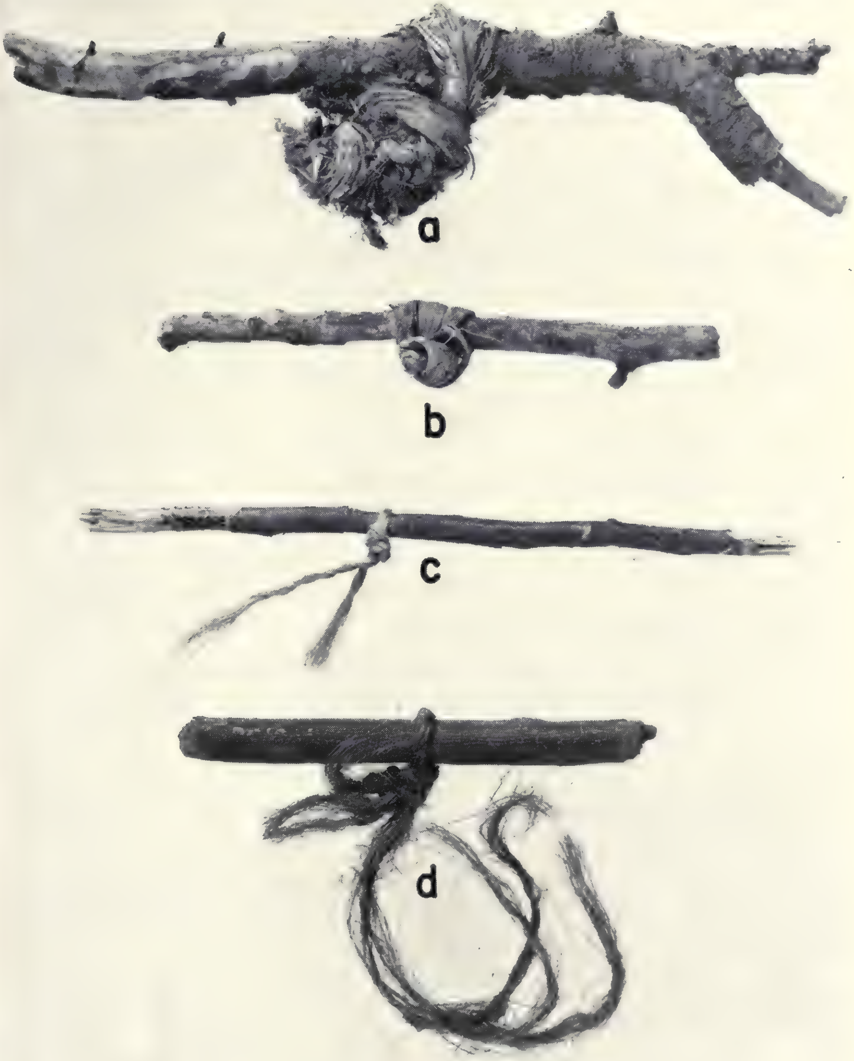


FIG. 150. Sticks with knotted yucca leaf bindings (*a*, *b*); toggles (*c*, *d*). Length of *d*, 19.3 cm.

Occurrence by Phase, Tularosa Cave.—Georgetown, 1.

Dimensions.—Length, 14.9 cm.; diameter, 1.2 cm.; blade length, 6.0 cm.

FLAT OBJECTS

Technique.—Straight stick used; bark remains except in spots; one end carved to shape and polished.

Shape.—Plano-convex in cross section; rectangular blade with rounded corners on one end; blade thinned in both width and thickness.

Occurrence by Phase, Tularosa Cave.—Georgetown, 1.

Dimensions.—Length, 13.0 cm.; width, 1.3 cm.; thickness, 0.5 cm.; length of blade, 2.7 cm.; width of blade, 0.8 cm.; thickness of blade, 0.2 cm.

Spatula

SPLIT STICK

Technique.—Straight stick split in two and smoothed; bark partially removed.

Shape.—One end cut to a blunt point which is polished smooth; opposite end roughly broken off.

Occurrence by Phase, Cordova Cave.—Late, 1.

Dimensions.—Length, 8.6 cm.; width, 1.0 cm.; thickness, 0.4 cm.

ROUNDED END

Technique.—Straight section split out of large branch; bark remains along one edge.

Shape.—Rectangular in cross section; one end is rounded to form a blade; tapers towards opposite end; blade tip is smoothed and charred; tapers in thickness towards narrow end.

Occurrence by Phase, Cordova Cave.—Late, 1.

Dimensions.—Length, 21.5 cm.; width, 2.0 (tapers to 1.2 cm.); thickness, 1.0 (tapers to 0.5 cm.).

Torches (Fig. 151)

PINE NEEDLE

Technique.—Small pine branch; tied, but otherwise unworked.

Shape.—End of twig tied to form ball of pine needles at the end of a slender handle formed by the twig.

Material.—Pine (*Pinus ponderosa*).

Occurrence by Phase, Tularosa Cave.—San Francisco-through-Tularosa, 1.

Dimensions.—Length, 16.5 cm.; size of ball, 8.0×6.0 cm.

BEAR GRASS ROOT

Technique.—Used in natural form; root.

Shape.—Root segment with charred leaves on one end.

Material.—Bear grass root.

Occurrence by Phase, Tularosa Cave.—Pre-Pottery, 1.

Dimensions.—Length, 9.4 cm.; diameter, 3.0 cm.

Split-Stick Tongs(?)

Technique.—Flexible sticks; bark left intact; split and bent into shape.

Shape.—Stick bent into U-shape at center; one with ends parallel, the other with ends crossing.

Occurrence by Phase, Tularosa Cave.—San Francisco, 2.

Occurrence by Phase, Cordova Cave.—Late, 1.

Dimensions.—Length, 27.8, 24.0, 12.0 cm.; width, 1.0, 1.0, 4.0 cm.; thickness, 1.0, 0.5, 0.8 cm.

Seedbeater(?) (Fig. 147, a)

Technique.—Forked stick; bark intact except in a few spots where it has flaked or been peeled off; handle end cut off roughly, leaving fibers.

Shape.—Three-branched fork on one end of the stick forms the head; the two outside branches of the fork are bent inward at 90 degree angles and overlap, forming a triangular head at the end of a long handle; center branch of fork and an added stick make a framework of four parallel twigs; fiber strips woven around outer frame branches and over-and-under inner branches to produce a woven webbing inside triangular head; 18 fiber strands used in the webbing.

Occurrence by Phase, Tularosa Cave.—Unplaced, 1.

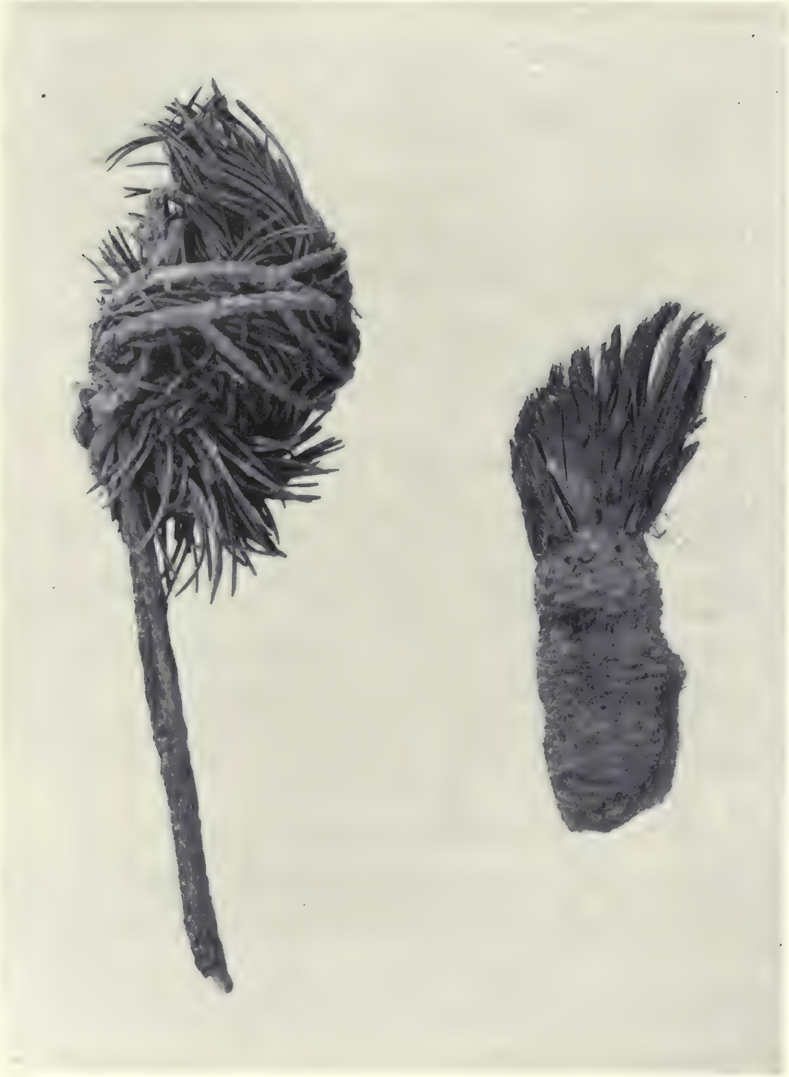


FIG. 151. Torches: pine needle (left); bear grass root (right). Length of torch at left, 16.5 cm.

Dimensions.—Length, 87.0 cm.; diameter of handle, 1.8 cm. (tapers to 1.2 cm.); length of head, 24.5 cm.; width of head, 13.7 cm. (tapers into handle).

Ceremonial Bows (Fig. 147, e, f)

Technique.—Small branches used; bark removed; carved to shape and smoothed; not carefully made or polished.

Shape.—Round in cross section except one San Francisco specimen, which is flat; all are self-bows.

Tips.—No nocks; some tips flattened; five tips bound with two-yarn yucca cord or strips of yucca fiber; marks of bow string present on many specimens, but no strings remain.

Decoration.—Nineteen unpainted; three with limbs painted red with black encircling parallel bands; two with red encircling parallel bands; four with black encircling parallel bands; twenty-six with limbs painted solid red; one from the Reserve–Tularosa levels painted with a Reserve Black-on-White pottery design.

Material.—Willow (*Salix* sp.).

Occurrence by Phases, Tularosa Cave.—San Francisco, 5; San Francisco-through-Tularosa, 25; Reserve-through-Tularosa, 20.

Occurrence by Phase, Cordova Cave.—Late, 5.

Dimensions.—Length, 85.0 cm. (complete), 28.7–86.5 cm. (fragments); diameter, 0.6–1.6 cm.

Miniature Bow and Arrow Sets (Fig. 152)

Technique.—Small branches used; bark removed; roughly scraped and smoothed.

Shape.—Round in cross section; self-bows.

Tips.—No nocks present; two-yarn yucca cord bowstring on one specimen.

Special Features.—A bundle of miniature reed arrows attached to each bow, by means of cotton and yucca cord; tips of arrows blunt; each arrow feathered with tail feathers of young road-runner; three arrows on one bow, six on the other.

Decoration.—Larger specimen with red limbs; smaller specimen painted red all over.

Materials.—Willow (*Salix* sp.); reed (*Phragmites communis*).

Occurrence by Phases, Tularosa Cave.—San Francisco-through-Tularosa, 2.

Dimensions.—Length, 30.0, 21.3 cm.; diameter, 0.3, 0.6 cm.; length of arrow, 19.0–23.3 cm.; diameter of arrow, 0.2–0.5 cm.

Miniature Bows

Technique.—Same as above; one with bark remaining.

Shape.—Round in cross section; self-bows.

Tips.—No nocks or bowstrings present.

Decoration.—Unpainted.

Material.—Willow (*Salix* sp.).

Occurrence by Phases, Tularosa Cave.—San Francisco, 1; San Francisco-through-Tularosa, 6.

Occurrence by Phase, Cordova Cave.—Late, 4.

Dimensions.—Length, 22.9–31.3 cm. (complete); diameter, 0.5–0.6 cm.

Miniature Arrows

Technique.—Sections of reed used; several nodes present; unworked.

Shape.—Straight sections of reed; no notches present; no foreshafts present; stubby blunt tips.

Fletching.—Four specimens with feathers remaining; three feathers on each specimen; sinew bindings for feathering present on all specimens, feathers having worn off; feathers on two are the back feathers of the chestnut-backed bluebird; others unidentifiable.

Decoration.—None.

Material.—Reed (*Phragmites communis*).

Occurrence by Phases, Tularosa Cave.—Pine Lawn, 1; San Francisco, 7; San Francisco-through-Tularosa, 30.

Occurrence by Phase, Cordova Cave.—Late, 2.

Dimensions.—Length, 15.0–25.9 cm. (complete); diameter, 0.4–0.5 cm.

Juniper-Berry Skewers

Technique.—Body and shaft carved from single twig; breaking, cutting, scraping and carving marks on surface of shaft and ends of body; bark usually removed.

Shape.—Tapering, pointed shaft protruding from one end of cylindrical body; shaft nearer to rim of body than to center; body

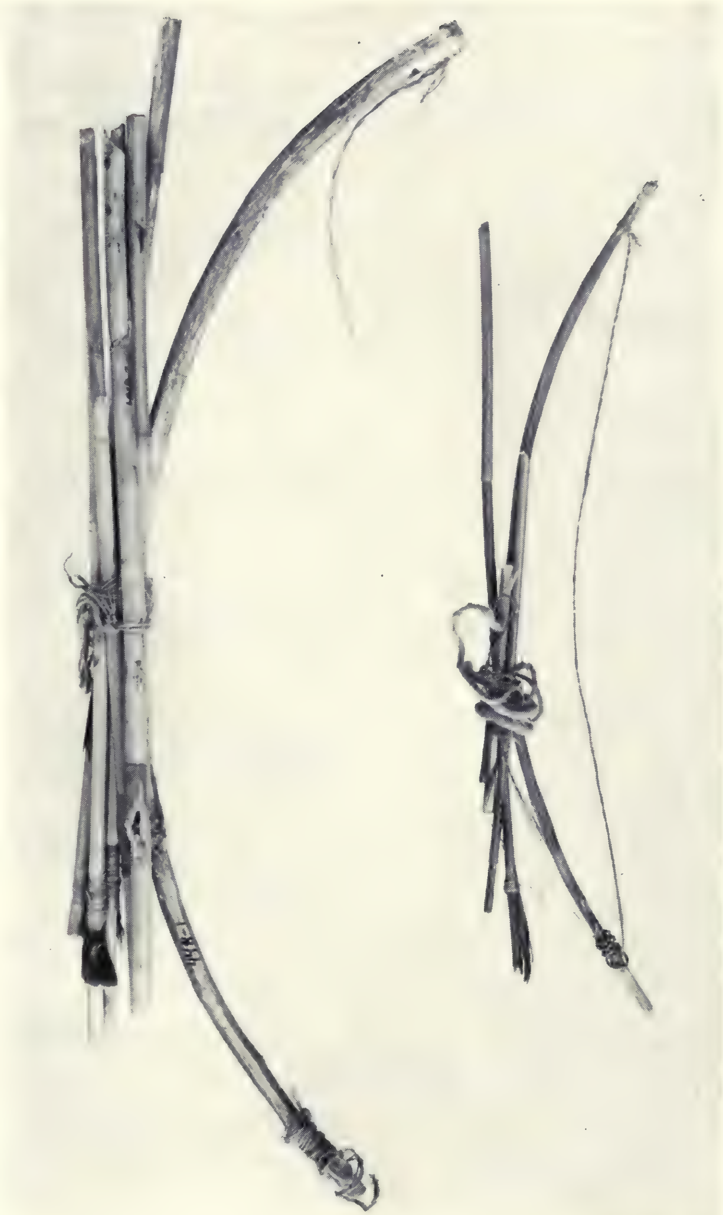


FIG. 152. Miniature bow and arrow sets. Length of bow at left, 30 cm.

diameter that of original twig; shaft diameter greatly reduced; shaft about two-thirds of over-all length.

Decoration.—Twenty with portions of bark remaining on body; patterns are questionable; eight with Juniper berries impaled on shaft (Fig. 153, *c*, *e*, *g*, *j*, *l*, *o*).

Remarks.—Several descriptive categories based on shaft position, removal of bark, and degree of finish on ends of body; term "lateral shaft" means that shaft is a continuation, at its base, of body cylinder; an "offset shaft" does not touch rim of body cylinder but is not in center of body; variations seem to be accidents of manufacture rather than intentional; one specimen has body split in two, repaired with sinew binding 0.7 cm. wide (Fig. 153, *a*).

Materials.—Oak (*Quercus* sp.); cliffrose (*Cowania stansburiana*).

LATERAL SHAFT, BARK REMOVED, ENDS ROUGH: 9 (FIG. 153, *m*)

Occurrence by Phases, Tularosa Cave.—Pre-Pottery, 1; Pine Lawn, 2; Pine Lawn-through-Georgetown, 1; Georgetown, 3; San Francisco, 1; San Francisco-through-Tularosa, 1.

LATERAL SHAFT, BARK REMOVED, ENDS SMOOTH: 8 (FIG. 153, *k*)

Occurrence by Phases, Tularosa Cave.—Pre-Pottery, 2; Pine Lawn, 1; San Francisco, 4; San Francisco-through-Tularosa, 1.

LATERAL SHAFT, BARK INTACT, ENDS ROUGH: 13 (FIG. 153, *p*)

Occurrence by Phases, Tularosa Cave.—Pre-Pottery, 2; Pine Lawn, 2; Pine Lawn-through-Georgetown, 1; Georgetown, 4; San Francisco, 2; San Francisco-through-Tularosa, 2.

LATERAL SHAFT, BARK INTACT, ENDS SMOOTH: 3 (FIG. 153, *n*)

Occurrence by Phases, Tularosa Cave.—Pre-Pottery, 1; San Francisco, 1; San Francisco-through-Tularosa, 1.

OFFSET SHAFT, BARK REMOVED, ENDS ROUGH: 16 (FIG. 153, *f*)

Occurrence by Phases, Tularosa Cave.—Pre-Pottery, 2; Pine Lawn, 2; Pine Lawn-through-Georgetown, 1; Georgetown, 3; San Francisco-through-Tularosa, 8 (1 repaired).

OFFSET SHAFT, BARK REMOVED, ENDS SMOOTH: 5 (FIG. 153, *d*)

Occurrence by Phases, Tularosa Cave.—Pre-Pottery, 1; Pine Lawn, 2; San Francisco-through-Tularosa, 2.

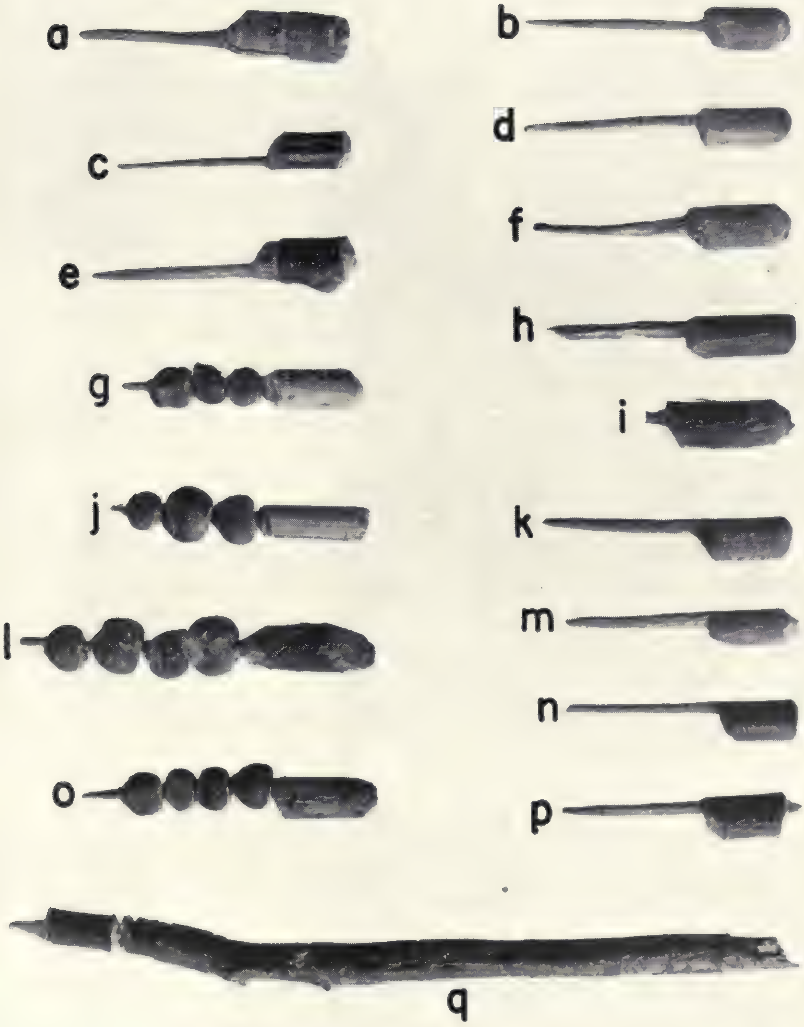

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FIG. 153. Juniper-berry skewers. Length of *q*, 16.2 cm.

OFFSET SHAFT, BARK INTACT, ENDS ROUGH: 8 (FIG. 153, *i*)

Occurrence by Phases, Tularosa Cave.—Pre-Pottery, 1; Pine Lawn, 3; Pine Lawn-through-Georgetown, 1; Georgetown, 1.

Occurrence by Phase, Cordova Cave.—Late, 2.

OFFSET SHAFT, BARK INTACT, ENDS SMOOTH: 4 (FIG. 153, *h*)

Occurrence by Phases, Tularosa Cave.—Pine Lawn, 1; Georgetown, 1; San Francisco, 1.

Occurrence by Phase, Cordova Cave.—Plain Ware, 1.

CENTRAL SHAFT, BARK REMOVED, ENDS SMOOTHED: 1 (FIG. 153, *b*)

Occurrence by Phase, Tularosa Cave.—Pre-Pottery, 1.

Dimensions.—Over-all length, 5.1–7.3 cm. (average, 5.8 cm.); diameter of body, 0.7–1.0 cm. (average, 0.8 cm.); diameter of shaft, 0.2–0.4 cm. (average, 0.3 cm.); length of body, 1.4–2.8 cm. (average, 2.0 cm.); length of shaft, 3.4–4.7 cm. (average, 3.8 cm.).

Unfinished Juniper-Berry Skewers (Fig. 153, q)

Technique.—Same as above, but show stages of manufacture.

Shape.—Twigs with portion of body and shaft carved on one end.

Occurrence by Phases, Tularosa Cave.—Georgetown, 2 (1 lateral shaft; 1 offset shaft); San Francisco-through-Tularosa, 1 (no shaft, fragmentary).

Dimensions.—Length, 16.2, 10.2 cm.; diameter, 0.8, 0.9 cm.; skewer body length, 1.5 cm.

Reed Cigarettes

Technique.—Segments of reed, including one node, are used; ends of the shaft are cut off squarely at right angles to the long axis of the cigarette.

COTTON-WRAPPED REED CIGARETTES (FIG. 154, *e–h*)

Shape.—Short cane tubes; node in center; septum pierced; one end filled with small dried stems of wild tobacco (*Nicotiana attenuata*); opposite end empty; no specimens of this type charred. Specimens from Cordova Cave have no binding but do have marks of bindings; they contain no tobacco.

Decoration.—Cotton yarn wrapped (5 to 10 turns) around node; free end of yarn slipped under last turn and pulled tight (no knot).

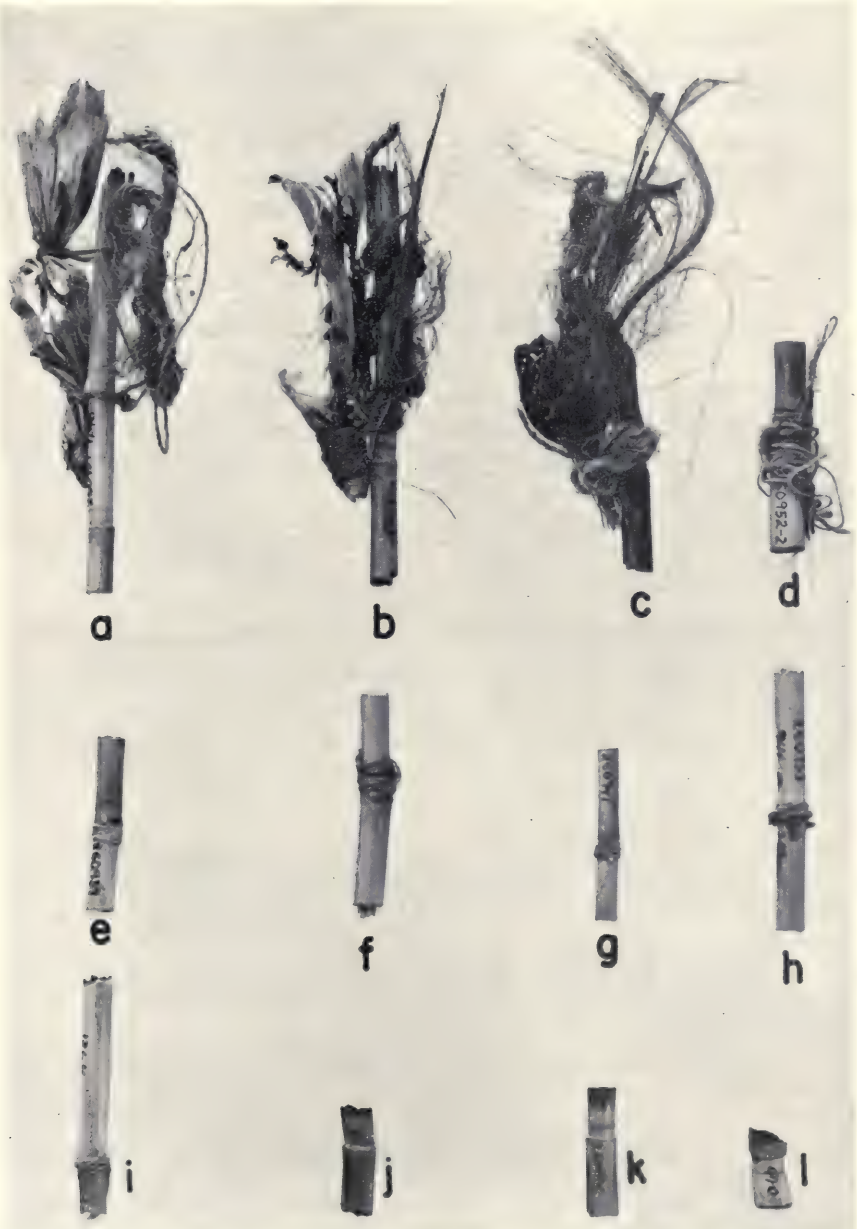
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FIG. 154. Reed cigarettes: *a–d*, bundle-decorated; *e–h*, cotton-wrapped; *i*, long, plain; *j–l*, butts. Length of *i*, 6.0 cm.

Occurrence by Phases, Tularosa Cave.—Georgetown, 2; San Francisco, 2; San Francisco-through-Tularosa, 4; Reserve-through-Tularosa, 4.

Occurrence by Phases, Cordova Cave.—Plain Ware, 1; Late, 1.

Dimensions.—Length, 4.0–7.8 cm. (average, 5.5 cm.); diameter, 0.6–1.0 cm. (average, 0.7 cm.).

BUTTS OF REED CIGARETTES (FIG. 154, *j–l*)

Shape.—Short cane tube; node in center (must have been nearer one end in unburned specimen); septum pierced; one end charred.

Decoration.—None.

Occurrence by Phases, Tularosa Cave.—Pine Lawn, 1; Georgetown, 1; San Francisco, 2; San Francisco-through-Tularosa, 1; Reserve-through-Tularosa, 1.

Dimensions.—Length, 2.3–3.3 cm. (average, 2.9 cm.); diameter, 0.9–1.0 cm. (average, 1.0 cm.).

BUNDLE-DECORATED REED CIGARETTES (FIG. 154, *a–d*)

Shape.—Long reed tube; node near one end; septum pierced; end opposite node charred; long end of tube filled with small dried stems of wild tobacco (probably *Nicotiana attenuata*); one specimen of short tube with node in center, not charred, filled with crushed tobacco stems.

Decoration.—Bunches of cotton yarn, corn husk, animal hair, feathers attached to fiber cords, and seedling Juniper plants are attached to the reed cigarette with bast fiber strings, one string at each end of the cigarette.

Occurrence by Phase, Tularosa Cave.—San Francisco-through-Tularosa, 4.

Dimensions.—Length, 12.4, 12.5, 5.7 cm. (one fragment not measured); diameter, 0.7, 0.8, 1.0 cm.

LONG, PLAIN REED CIGARETTES (FIG. 154, *i*)

Shape.—Long reed tube; node near end; septum pierced; opposite end charred; when fully burned would produce butt (see above); no contents.

Occurrence by Phase, Tularosa Cave.—Unplaced, 2.

Dimensions.—Length, 6.0 cm.; diameter, 0.7 cm.

DECORATION MATERIAL

Decoration.—Corn husk fragment and bundle of cotton yarn.

Occurrence by Phase, Tularosa Cave.—San Francisco-through-Tularosa, 1.

Material (all cigarettes).—Reed (*Phragmites communis*), cotton, tobacco (*Nicotiana attenuata?*).

Tablitas

Technique.—Made of single pieces; thin sections split from wide pieces of wood; surfaces not smoothed.

Shape.—Rectangular outline; two pairs of holes, each located near center and halfway between middle and ends of tablita; separate twisted fiber cord passes through each pair of holes and is tied with a square or granny knot; some cords not tied; most specimens lack cords; paint on one cord indicates that painting of tablita followed attachment of cord.

Decoration.—Painted decoration in one or several colors.

A. Central diamond pattern; diamond shape with ends at center of sides and ends of tablita; ends of diamond truncated by edge of tablita; surface unpainted between corners and edges of diamond pattern; corners painted, with diagonal edge parallel to sides of central diamond; one painted solid black from edge of central diamond to corners (Figs. 155, *b*, *d*, *g*, 156). The varieties of this pattern are:

Green diamond; corners of tablita black.

Green diamond; black from diamond to corners; cords in place when painted (stained green).

Green diamond with black border; corners of tablita black.

Black diamond with red border; corners unpainted; flecks of green in the black; 0.3 cm. diameter hole in center of tablita.

Black diamond; Plain Ware Phase.

White(?) diamond.

White or green(?) diamond.

Occurrence by Phase, Cordova Cave.—Plain Ware, 1; Late, 6.

B. Solid red; both sides painted red all over; cords in place when painted (stained red) (Fig. 155, *e*).

Occurrence by Phase, Cordova Cave.—Late, 2.

C. Plain; undecorated (Fig. 155, *a*, *c*).

Occurrence by Phase, Cordova Cave.—Late, 3 (one identifiable fragment).

Dimensions (for A, B and C).—Length, 11.1–13.5 cm. (average, 12.6 cm.); width, 5.7–8.7 cm. (average, 7.6 cm.); thickness, 0.1–0.3 cm. (average, 0.2 cm.); distance of holes from ends, 1.5–4.1 cm. (average, 2.4 cm.); distance between holes (in one pair), 0.4–1.1 cm. (average, 0.7 cm.); diameter of holes, 0.1 cm.; length of cord (longest free hanging end), 20.0 cm.

D. Rounded top (Fig. 155, *f*).

Shape.—Straight bottom, rounded corners; curving sides arch to a narrow rounded top; other features same as above; fragments.

Decoration.—None.

Occurrence by Phase, Cordova Cave.—Plain Ware, 1; Late, 1.

Dimensions.—Length, 11.2 cm.; width, (fragment); thickness, 0.2 cm.; distance of holes from ends, 4.0, 1.8 cm.; distance between holes in pair, 1.2, 1.1 cm.; diameter of holes, 0.1 cm.

E. Tablita fragments.

Occurrence by Phases, Cordova Cave.—Plain Ware, 2; Late, 27.

Material.—Wood.

Painted Sticks

Technique.—Straight, slender sticks used; bark removed.

Shape.—One end cut off evenly; opposite end broken; all are fragmentary.

Decoration.—Various combinations and colors.

A. Green: Traces of green paint. No pattern visible.

Occurrence by Phase, Tularosa Cave.—San Francisco, 2.

Occurrence by Phase, Cordova Cave.—Late, 1.

B. Green and black: Alternating bands of green and black (Fig. 157, *h–j*).

Occurrence by Phase, Tularosa Cave.—San Francisco, 3.

Occurrence by Phases, Cordova Cave.—Plain Ware, 1; Late, 1.

C. Red and black: Alternating bands of red and black; black applied over green in specimen from Tularosa Cave.

Occurrence by Phase, Tularosa Cave.—San Francisco-through-Tularosa, 1.

Occurrence by Phase, Cordova Cave.—Late, 1.

D. Green, black, red and plain: Alternating bands of varying width.

Occurrence by Phase, Cordova Cave.—Late, 1.

E. Black and plain: Dark painted bands alternating with unpainted surface.

Occurrence by Phase, Tularosa Cave.—San Francisco-through-Tularosa, 1.

Occurrence by Phase, Cordova Cave.—Late, 1.

F. Black spiral: Ends black, connected by spiraling band 0.3 cm. wide; plain inter-spiral band 3.0 cm. wide.

Occurrence by Phase, Cordova Cave.—Pre-Pottery, 1.

G. Red: Entire surface painted red. One specimen from Tularosa Cave is a split stick and has a small bundle of vegetal material bound to it with fiber (Fig. 157, *k*).

Occurrence by Phase, Tularosa Cave.—San Francisco-through-Tularosa, 2.

Occurrence by Phase, Cordova Cave.—Late, 1.

Dimensions.—Length, 5.2–24.8 cm.; diameter, 0.4–0.9 cm.

Carved Paho (Fig. 146, i)

Technique.—Straight stick; bark removed; whittled to shape.

Shape.—Rounded; fragment with two lobes separated by encircling groove.

Decoration.—Painted red all over.

Occurrence by Phase, Cordova Cave.—Late, 1.

Dimensions.—Length, 4.6 cm. (fragment); diameter, 1.5 cm.

Wooden Dice (Fig. 157, a–g)

Technique.—Split sticks; bark removed; ends cut off at right angles to long axis and smoothed.

Shape.—Plano-convex in cross section; rectangular in outline.

Decoration.—Decoration produced by removal of bark or pith, or by painting or burning surfaces. Pre-Pottery specimens: one with bark removed and dark brown stripe down center of flat side (stripe is natural); one with flat side plain and convex side decorated

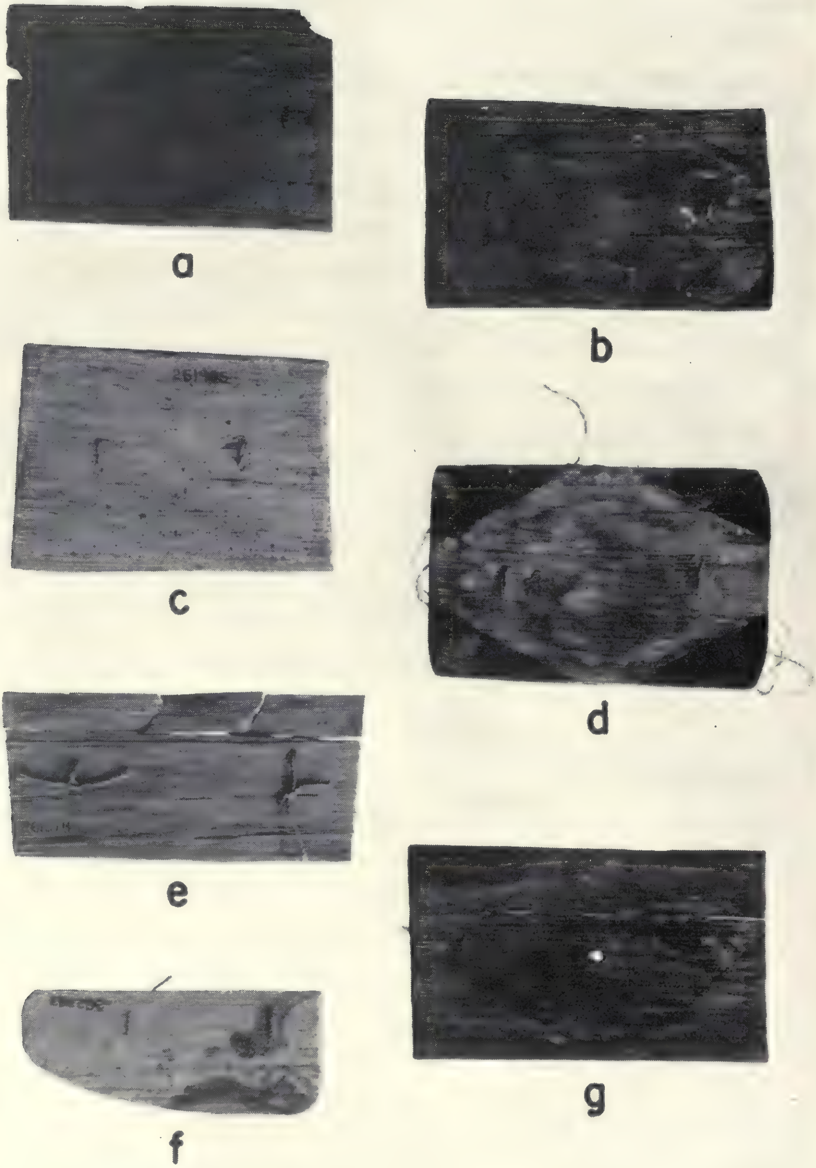

FIG. 155. Tablitas: *a*, *c*, plain; *b*, *d*, *g*, central diamond pattern; *e*, painted solid red; *f*, rounded top. Length of *f*, 11.2 cm.

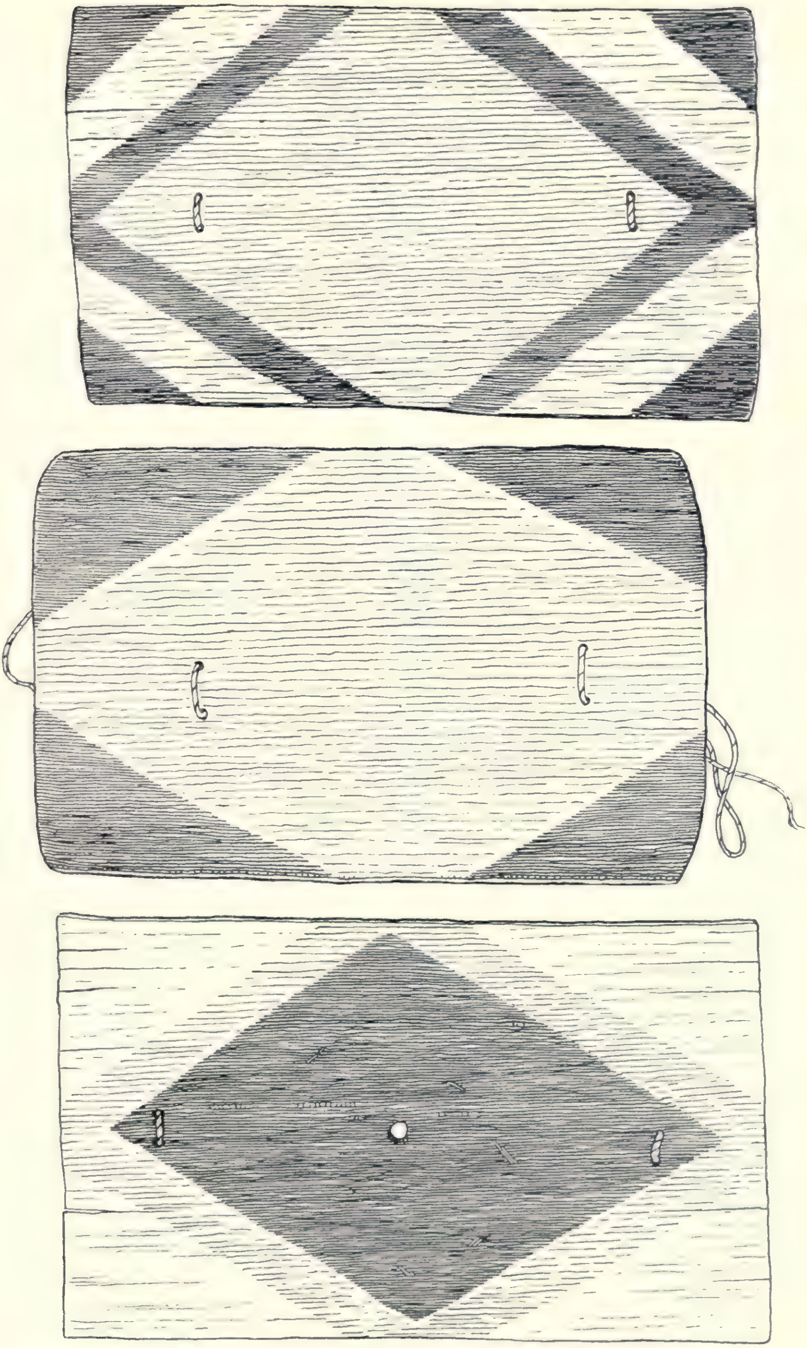

FIG. 156. Drawings of tablitas with central diamond pattern, shown in Figure 155.

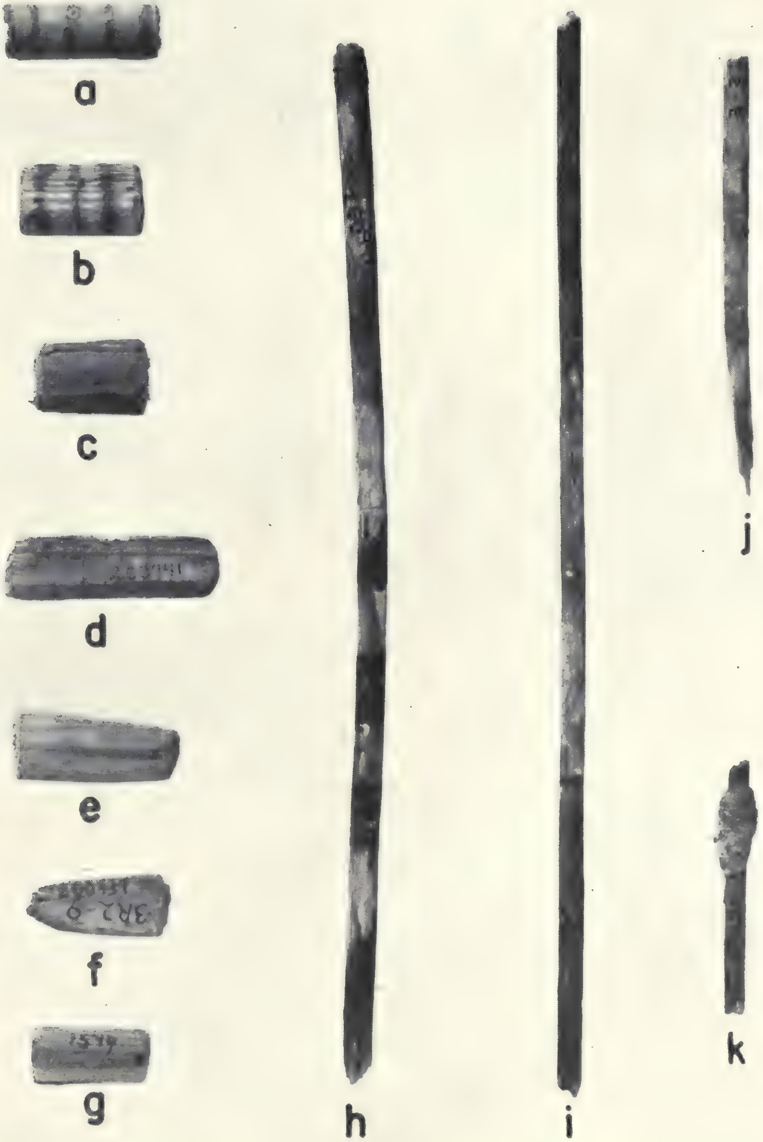
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FIG. 157. Wooden dice (*a–g*); painted sticks (*h–k*). Length of *d*, 4.3 cm.

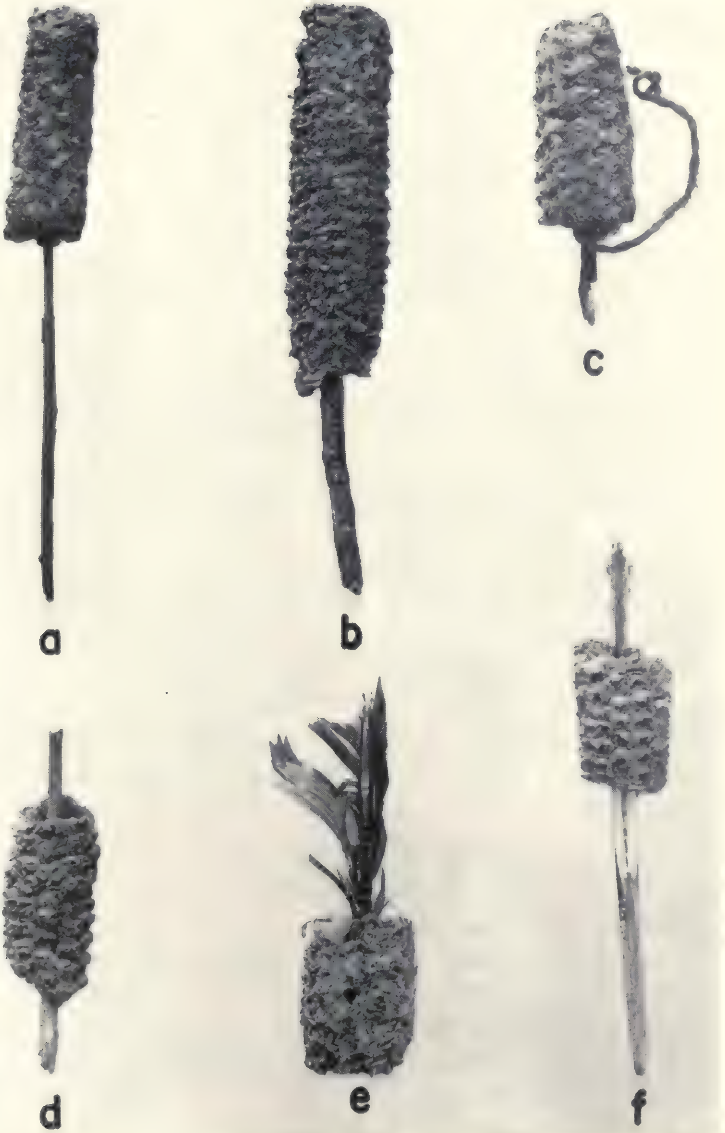

FIG. 158. Corn cobs mounted on sticks (*a–d*); corn cobs mounted on feathers (*e, f*). Length of *f*, 12 cm.

by removing a strip of bark from the center, leaving narrow strips of bark along each edge. Georgetown specimens: one narrow central trough in flat side formed by removing pith; one with three burned lines at evenly spaced intervals across flat side. San Francisco specimen: flat side painted black, five evenly spaced lines burned across convex side. Cordova Cave specimens undecorated.

Occurrence by Phases, Tularosa Cave.—Pre-Pottery, 2; Pine Lawn, 1; Georgetown, 3; San Francisco, 1.

Occurrence by Phases, Cordova Cave.—Plain Ware, 1; Late, 1.

Dimensions.—Length, 2.2–4.3 cm. (average, 2.9 cm.); width, 0.4–1.5 cm. (average, 0.5 cm.); thickness, 0.4–0.6 cm. (average, 0.5 cm.).

Corn Cobs Mounted on Sticks (Fig. 158, a–d)

Technique.—Corn cobs impaled on sticks; in all but one San Francisco specimen the stick is in the base of the cob.

Shape.—Stick protrudes from one end of the cob only, except in the San Francisco-through-Tularosa specimen, in which the stick protrudes from both ends.

Decoration.—Two specimens, one Pine Lawn and one San Francisco, have twisted hard fiber cord protruding from the same hole as the stick.

Material.—Corn cobs. Pre-Pottery specimen cob probably from Pine Lawn or Georgetown phases. Wood.

Occurrence by Phases, Tularosa Cave.—Pre-Pottery, 1; Pine Lawn, 4; San Francisco, 5; San Francisco-through-Tularosa, 1.

Dimensions.—Length, 6.0–13.4 cm.; diameter of stick, 0.2–0.7 cm.

Corn Cobs Mounted on Feathers (Fig. 158, e, f)

Technique.—Same as above.

Shape.—Feather quill protrudes from one end only in surface specimen, from both ends in the San Francisco specimen.

Material.—Corn cob of surface find different from any in cave.

Occurrence by Phases, Tularosa Cave.—San Francisco-through-Tularosa, 1; surface, 1.

Dimensions.—Length, 12.0, 8.7 cm.

Feathers Mounted on Sticks (Fig. 159)

Technique.—Short twigs or splinters of wood used; unworked.

Shape.—One or two feathers attached by sinew binding around quill to end of stick; one specimen with a mass of wild turkey feathers tied to stick; one with a mass of feathers bound to center of stick (5.0 cm. from end); feathers encircle stick.

Material.—Wild turkey feathers, feather quill fragments, wood.

Occurrence by Phases, Tularosa Cave.—Pre-Pottery, 1; Georgetown, 4; San Francisco-through-Tularosa, 2.

Occurrence by Phase, Cordova Cave.—Late, 1.

Dimensions.—Length, 3.7–19.1 cm. (average, 12.0 cm.); diameter, 0.3–0.9 cm.

Reed Stalks Mounted on Reed Stems (Fig. 160)

Technique.—Stalk is lowest portion of reed plant; cut off squarely at right angles to long axis on each end. Stem is section of reed containing one or more nodes; both ends are splintered and were broken off rather than cut.

Shape.—Stalk has a node, septum remaining intact, at one end; stem inserted through opposite open end.

Material.—Reed (*Phragmites communis*).

Occurrence by Phases, Tularosa Cave.—Pine Lawn, 2 (one has gray pithy tube instead of reed stalk); Georgetown, 1; Georgetown–San Francisco, 1; San Francisco, 4; San Francisco-through-Tularosa, 4.

Dimensions.—Length, 7.8–26.8 cm. (average, 15.8 cm.); length of stalk, 4.5–10.5 cm. (average, 8.0 cm.); diameter of stalk, 0.9–1.6 cm. (average, 1.2 cm.); diameter of stem, 0.5–0.8 cm. (average, 0.6 cm.).

Reed Flutes (Fig. 161)

Technique.—Sections of cane with one or more nodes used; finger holes cut in reed.

Shape.—Straight sections of reed with septums pierced; round holes in row along one side, approximately equal distances apart; one specimen with node in center and holes close to node.

Decoration.—Two specimens decorated with burned bands 1.0 cm. wide, in one case near a node, in the other near the end of the specimen.

Material.—Reed (*Phragmites communis*).

Occurrence by Phases, Tularosa Cave.—Pre-Pottery, 2 (one with decoration at each end, near nodes); Pine Lawn, 1 (node in center); Georgetown, 1 (decoration near one end).

Dimensions.—Length, 10.9, 22.7, 6.9, 5.9 cm. (fragments); diameter, 1.1, 0.8, 1.0 cm.; number of holes, 2, 3, 2, 3; distance between holes, 3.0, 6.4, 0.5, 2.0 cm.

Sticks with Incised Patterns in Bark

SCRATCHED PATTERNS (FIG. 148, *c*)

Technique.—Straight stick; bark intact; one end cut off evenly; opposite end broken.

Shape.—Straight cylinder.

Decoration.—Zigzag lines incised in bark in two series of three lines each; lines run longitudinally and are spaced equal distances apart around circumference of stick; lines in each series of equal length, but one series longer than the other; lines appear light gray on a dark background.

Occurrence by Phase, Tularosa Cave.—Pre-Pottery, 1.

Dimensions.—Length, 20.5 cm.; diameter, 1.0 cm.; length of incised lines, 9.0 and 3.0 cm.

PEELED PATTERNS

Technique.—Straight sticks used; ends smoothed and polished; bark partially peeled off.

Shape.—Straight sticks with rounded ends.

A. *Burned Decoration.*—Band of bark beginning 2.7 cm. from end of stick; opposite end broken off; bark band 12.0 cm. long; burned stripe 0.3 cm. wide runs lengthwise along entire bark-covered area.

Occurrence by Phase, Tularosa Cave.—Pre-Pottery, 1.

Dimensions.—Length, 36.8 cm. (fragment); diameter, 1.0 cm.

B. *Spiral Decoration.*—Bark peeled off 4.5 cm. and 7.3 cm. on each end; bark band 42.2 cm. long; bark removed in spiral strip 0.2 cm. wide along entire length of bark-covered portion.

Occurrence by Phase, Tularosa Cave.—Pine Lawn, 1.

Dimensions.—Length, 54.0 cm.; diameter, 1.2 cm.

C. *Lengthwise Decoration.*—Three lengthwise strips removed, 0.5 cm. wide; inner bark remains.

Occurrence by Phase, Tularosa Cave.—Georgetown, 1.

Dimensions.—Length, 17.5 cm.; diameter, 1.2 cm.

D. *Diamond Decoration.*—Ends of stick cut off at right angles to long axis, but not rounded or smoothed; bark peeled off in spots; an incised interlocking diamond pattern.

Occurrence by Phase, Tularosa Cave.—Georgetown, 1.

Dimensions.—Length, 13.0 cm.; diameter, 1.5 cm.

E. *Band Decoration.*—Bark removed except for band 4.0 cm. wide, 12.5 cm. from end of stick; cutting marks around end of stick.

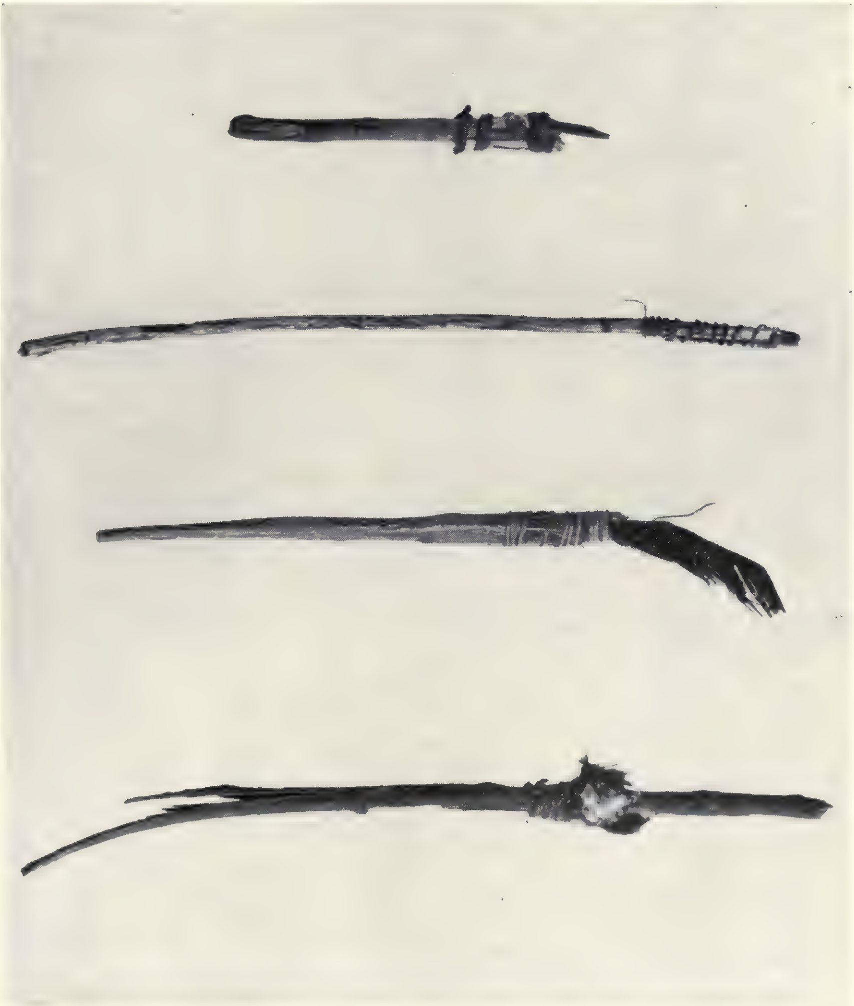

FIG. 159. Feathers mounted on sticks. Length of specimen at bottom, 19.1 cm.

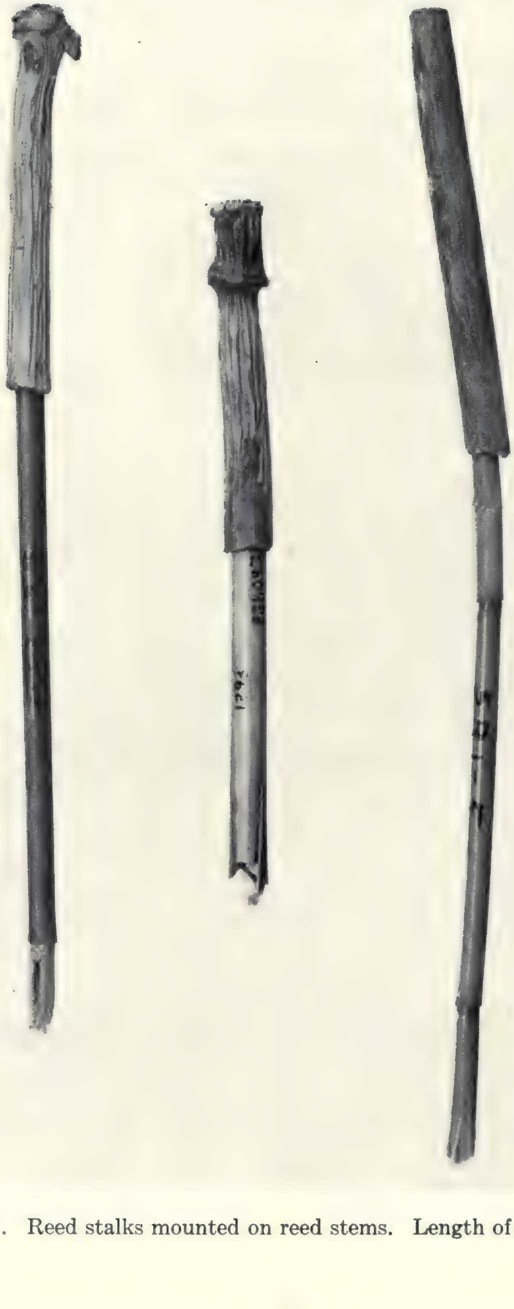

FIG. 160. Reed stalks mounted on reed stems. Length of specimen at right, 26.8 cm.

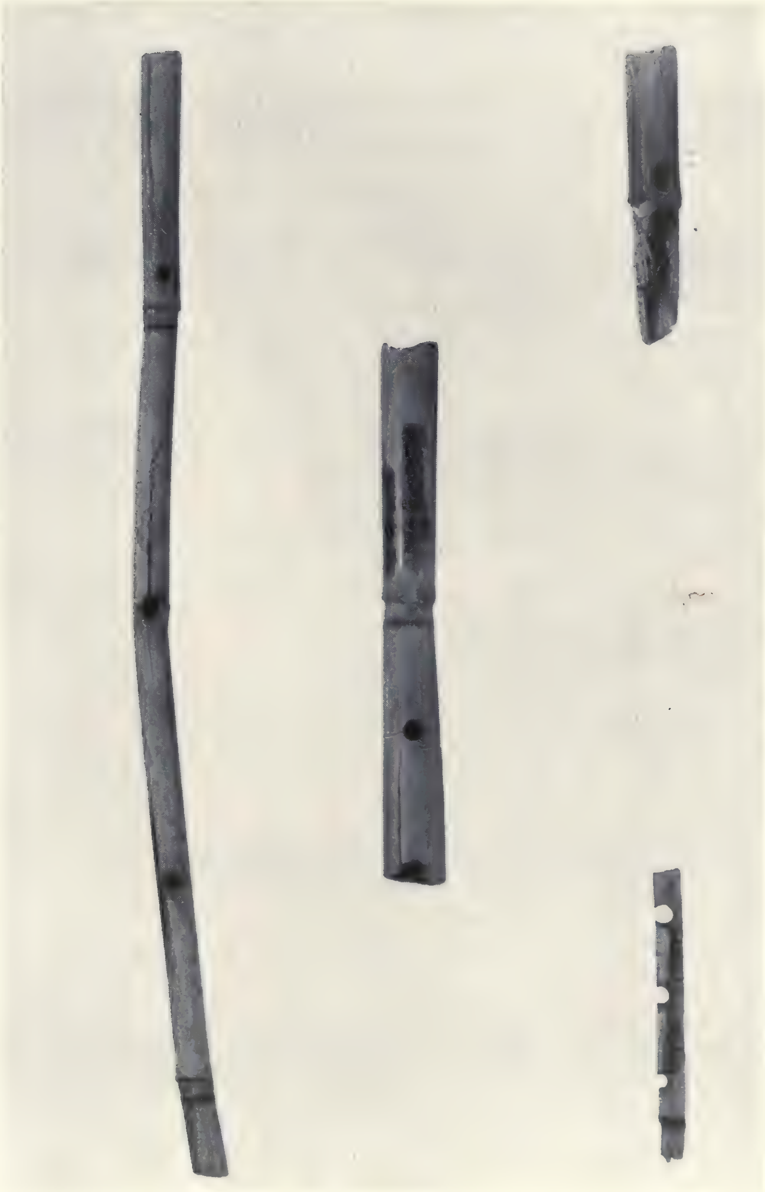

FIG. 161. Reed flutes. Length of specimen at left, 22.7 cm.

Occurrence by Phase, Tularosa Cave.—San Francisco, 1.

Dimensions.—Length, 41.3 cm.; diameter, 1.4 cm.

Wooden Cylinders

Technique.—Straight sticks; bark peeled; ends cut and smoothed.

GROOVED CYLINDERS (FIG. 162, *a*)

Shape.—Bark remains; encircling groove around center cuts through bark but not into wood.

Material.—Willow (*Salix* sp.).

Occurrence by Phase, Tularosa Cave.—San Francisco, 1.

Dimensions.—Length, 6.5 cm.; diameter, 0.9 cm.

NOTCHED CYLINDER (FIG. 162, *b*)

Shape.—V-shaped notch cut in one side; one end of specimen broken off.

Occurrence by Phase, Tularosa Cave.—San Francisco-through-Tularosa, 1.

Dimensions.—Length, 5.0 cm.; diameter, 0.8 cm.; width of notch, 0.5 cm.; depth of notch, 0.2 cm.

POLISHED CYLINDER (FIG. 162, *d*)

Shape.—Very short; all surfaces polished.

Occurrence by Phase, Tularosa Cave.—San Francisco-through-Tularosa, 1.

Dimensions.—Length, 1.2 cm.; diameter, 1.1 cm.

PLAIN CYLINDER (FIG. 162, *c, e–i*)

Shape.—Ends smoothed.

Occurrence by Phases, Tularosa Cave.—Pre-Pottery, 7; Pine Lawn, 4; Pine Lawn-through-Georgetown, 1; Georgetown, 2; San Francisco, 2; San Francisco-through-Tularosa, 1.

Occurrence by Phases, Cordova Cave.—Plain Ware, 5; Late, 2.

Dimensions.—Length, 1.8–16.5 cm. (average, 9.1 cm.); diameter, 0.8–1.6 cm. (average, 1.0 cm.).

Split Sticks

STRAIGHT

Technique.—Straight sticks used; split in two; bark removed except on two specimens; ends cut off at right angles to long axis.

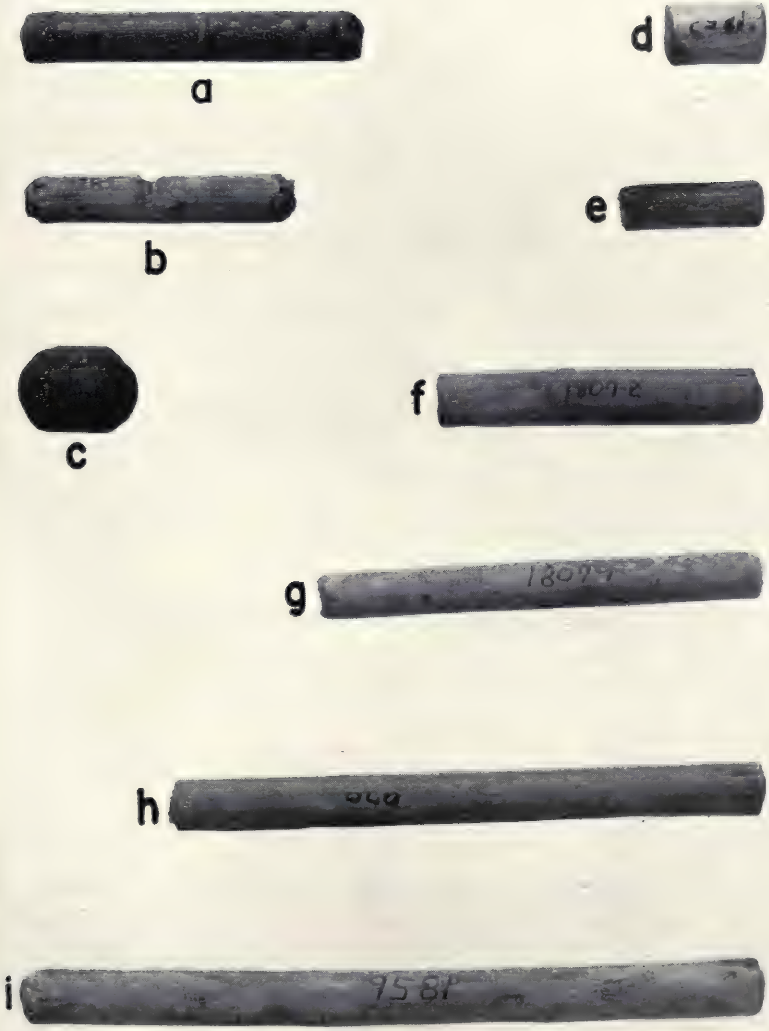

FIG. 162. Wooden cylinders: *a*, grooved; *b*, notched; *c*, *e–i*, plain; *d*, polished. Length of *i*, 16.5 cm.

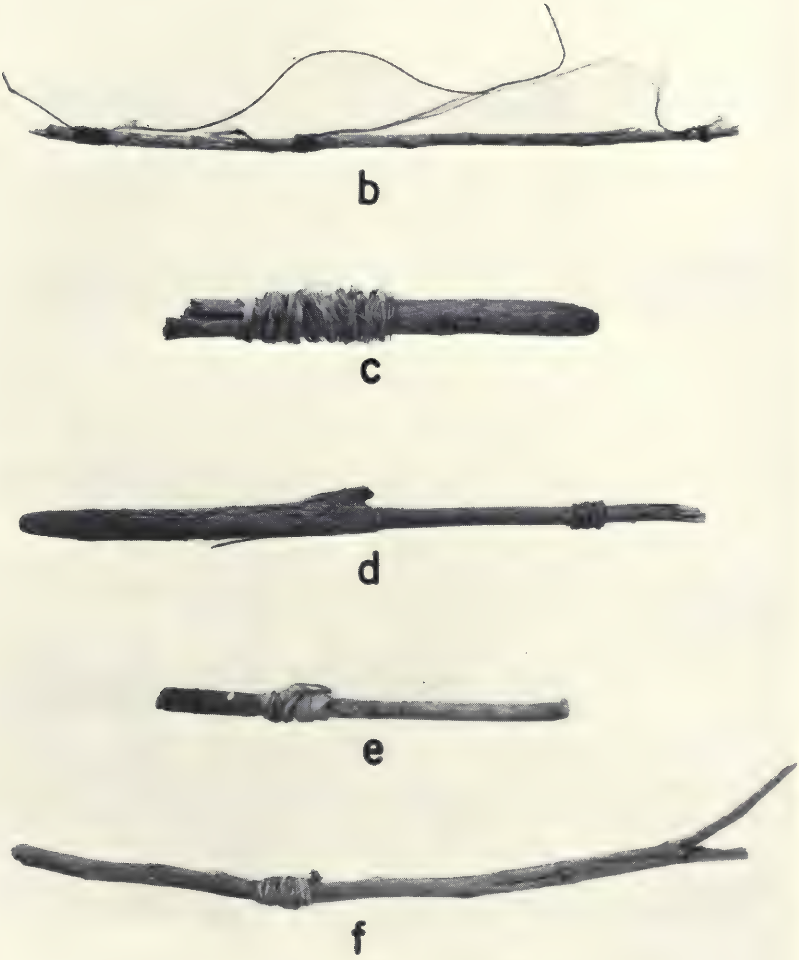

FIG. 163. Sticks with fiber, sinew and hair binding: *a*, fiber and hair; *b*, hair; *c*, *d*, fiber; *e*, *f*, sinew. Length of *b*, 16.5 cm.

Shape.—Plano-convex in cross section; rectangular in outline.

Occurrence by Phases, Tularosa Cave.—Pre-Pottery, 3; Georgetown, 2 (bark remains on one); San Francisco, 1; San Francisco-through-Tularosa, 1 (bark remains).

Occurrence by Phases, Cordova Cave.—Pre-Pottery, 2; Plain Ware, 1; Late, 2.

Dimensions.—Length, 4.0–27.0 cm. (average, 15.5 cm.); width, 1.0–1.2 cm. (average, 1.1 cm.); thickness, 0.4–0.6 cm. (average, 0.5 cm.).

CURVED

Technique.—Bark removed; sticks split.

Shape.—Ends are slightly rounded; sticks have a longitudinal curve.

Occurrence by Phases, Cordova Cave.—Pre-Pottery, 1; Late, 4.

Dimensions.—Length, 6.0–15.5 cm.; width, 1.0–1.6 cm.; thickness, 0.5–1.0 cm.

Carved Wooden Object (Crook Fragment?) (Fig. 149, d)

Technique.—Curved twig used; bark peeled off; surface smoothed.

Shape.—Stick curves, ends 90 degree axis apart; one end broken off; opposite end rounded and smoothed.

Occurrence by Phase, Tularosa Cave.—San Francisco-through-Tularosa, 1.

Dimensions.—Length, 11.5 cm.; diameter, 1.0 cm.

Skewer (Fig. 148, g)

Technique.—Seven seed pods impaled on unworked twig.

Occurrence by Phase, Tularosa Cave.—San Francisco-through-Tularosa, 1.

Dimensions.—Length, 14.7 cm.; diameter, 0.2 cm.

Sticks with Fiber, Sinew or Hair Bindings

Technique.—Unworked twigs; ends broken; bark usually removed. Bindings wrapped several turns around sticks; free end of binding slipped under last turn and pulled tight; no knots; bindings usually near center of stick.

Material.—Willow (*Salix* sp.).

Decoration and Occurrence by Phase, Tularosa Cave.—Sinew binding (Fig. 163, *e, f*): Pre-Pottery, 1; San Francisco, 1. Fiber binding (Fig. 163, *c, d*): Pre-Pottery, 3 (one with bark remaining); Pine Lawn, 2 (binding near end); Pine Lawn-through-Georgetown, 1 (bark remains on half); Georgetown, 5 (one made of stick with smooth spindle carved on one end; binding is in center of spindle); San Francisco-through-Tularosa, 2 (bark remains on one); unplaced, 1. Fiber and hair bindings (Fig. 163, *a*): San Francisco, 1 (hair binding around center, fiber binding between hair and end). Hair binding (Fig. 163, *b*): San Francisco-through-Tularosa, 1 (three hair bindings; one near center, one at each end; hair hangs free and is twisted and knotted at the free end).

Decoration and Occurrence by Phase, Cordova Cave.—Cord binding: Late, 1. Fiber binding: Late, 1.

Dimensions.—Length, 4.9–20.5 cm. (average, 11.2 cm.); diameter, 0.3–1.1 cm. (average, 0.6 cm.).

Large Stick with Loose Fiber Binding

Technique.—Short, thick branch; ends cut; bark removed.

Shape.—Thin strand of fiber loosely wrapped around center of stick and tied.

Material.—Wood.

Occurrence by Phase, Tularosa Cave.—Pine Lawn, 1.

Dimensions.—Length, 11.0 cm.; diameter, 3.5 cm.

Hoops

ROUND HOOP (FIG. 164, *d*)

Technique.—Bent and tied.

Shape.—Round hoop formed by bending twig in circle and binding overlapping ends with fiber; one specimen with extra fiber binding on side opposite joint; fragments cut, not broken.

Material.—Wood.

Occurrence by Phase, Tularosa Cave.—Pre-Pottery, 1 (fragment); Pine Lawn, 1 (double fiber bindings); Georgetown, 1; San Francisco-through-Tularosa, 2 (fragments).

Dimensions.—Twig diameter, 1.1, 0.4, 0.9, 0.4 cm.; hoop diameter, 11.8, 14.3×12.9, 14.9, 5.0 cm.

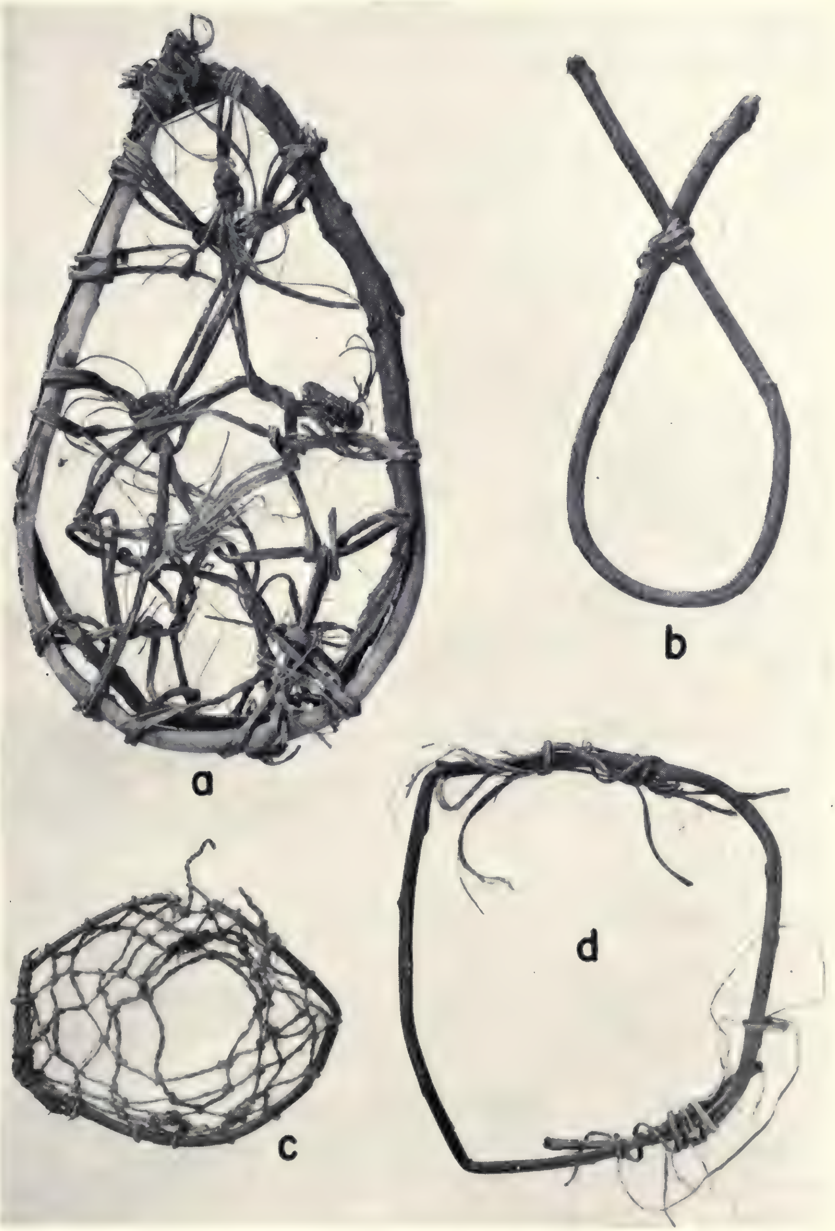

FIG. 164. Hoops and hoop-like object: *a*, fiber-netted hoop; *c*, cord-netted hoop; *d*, round hoop; *b*, hoop-like object. Length of *a*, 23.4 cm.

FIBER-NETTED HOOP (FIG. 164, *a*)

Technique.—Bent and tied.

Shape.—Oval hoop; twig bent to meet at ends, but not overlapping; ends bound together with fiber; coarse fiber netting of twined yucca leaves; large hole in center, surrounded by smaller ones.

Occurrence by Phase, Tularosa Cave.—San Francisco, 1.

Dimensions.—Twig diameter, 0.9 cm.; hoop dimensions, 23.4×13.2 cm.

CORD-NETTED HOOP (FIG. 164, *c*)

Technique.—Bent and tied.

Shape.—Twig bent into oval; ends overlapping and tied together with fiber; twisted fiber cord netting formed by knotting cord at crossing points; large opening at center of net, surrounded by smaller ones.

Occurrence by Phase, Tularosa Cave.—Pine Lawn, 1.

Dimensions.—Twig diameter, 0.4 cm.; hoop dimensions, 11.3×8.7 cm.

Hoop-like Objects (Fig. 164, b)

Technique.—Unworked twigs; bark remains.

Shape.—Bent into loop and tied in place; ends of stick extend beyond tie.

Occurrence by Phase, Tularosa Cave.—Pre-Pottery, 1; Pine Lawn, 1; Georgetown–San Francisco, 1 (fragment).

Dimensions.—Length, 18.7, 17.9 cm.; diameter of twig, 0.8, 0.4 cm.; length of twig beyond tie, 7.0, 10.0 cm.; dimensions of loop, 12.5×7.5, 6.0×2.4 cm.

Twigs Tied in Loops

Technique.—Small, flexible twigs used; bent and tied; bark remains.

Shape.—Twigs bent into double or single loops and tied with fiber or with end of twig; loop on one end.

Occurrence by Phase, Tularosa Cave.—Pre-Pottery, 1; Pine Lawn, 1; Georgetown, 2; San Francisco-through-Tularosa, 1.

Dimensions.—Length, 5.5–17.4 cm. (average, 11.9 cm.); dimensions of loop, 4.0×3.5–13.4×4.8 cm.; diameter of twig, 0.2–0.9 cm.

Sticks with Knotted Yucca Leaf Bindings (Fig. 150, a, b)

Technique.—Small branches or twigs used; untreated except for cutting or breaking of ends.

Shape.—Around center of twig a yucca leaf is bound one turn; excess fiber is tied and re-tied to form a large ball on one side of the stick.

Material.—Yucca leaves; wood.

Occurrence by Phases, Tularosa Cave.—San Francisco, 1; San Francisco-through-Tularosa, 11; Reserve-through-Tularosa, 1; unplaced, 1.

Dimensions.—Length, 9.8–35.0 cm. (average, 16.8 cm.); diameter, 0.4–1.5 cm. (average, 1.0 cm.); width of knot, 1.2–4.5 cm.; height of knot, 1.0–3.5 cm.

Bark Pendant (Fig. 149, c)

Technique.—Carved and smoothed.

Shape.—Rectangular in outline and cross section; corners rounded; round hole in center near one end.

Material.—Pine (*Pinus ponderosa*) bark.

Occurrence by Phase, Tularosa Cave.—Pre-Pottery, 1.

Dimensions.—Length, 5.9 cm.; width, 3.7 cm.; thickness, 0.9 cm.; diameter of hole, 0.6 cm. (hole 1.5 cm. from top edge).

Tooth-Marked Stick

Technique.—Ends of stick broken; bark removed.

Shape.—Straight stick with tooth impressions on opposite sides in straight rows.

Occurrence by Phase, Tularosa Cave.—San Francisco, 1.

Dimensions.—Length, 20.5 cm.; diameter, 1.1 cm.

Flattened Stick

Technique.—Straight stick; bark removed; carved to shape.

Shape.—Rectangular cross section; ends rounded and charred.

Occurrence by Phase, Tularosa Cave.—Georgetown, 1.

Dimensions.—Length, 22.1 cm.; width, 0.6 cm.; thickness, 0.3 cm.

Lap Board Fragments(?) (Fig. 145, f)

Technique.—Surfaces and edges of flat section of large branch or trunk are smoothed.

Shape.—Rectangular with rounded edges; split along one side; fragments.

Material.—Oak (*Quercus* sp.).

Occurrence by Phases, Tularosa Cave.—Pine Lawn, 1; San Francisco, 1 (slightly concave surface); San Francisco-through-Tularosa, 1.

Dimensions.—Length, 26.5, 26.2, 20.3 cm.; width, 4.3, 8.8, 1.8 cm. (fragments); thickness, 1.3, 1.3, 1.2 cm.

Carved Wooden Object (Pendant?) (Fig. 149, i)

Technique.—Carved to shape and polished.

Shape.—Leaf-shaped outline; both longitudinal and transverse cross sections convex on both surfaces, tapering to thin edges; broken in half lengthwise, split along grain.

Decorations.—Three incised grooves across top.

Material.—Oak (*Quercus* sp.).

Occurrence by Phase, Tularosa Cave.—Pre-Pottery, 1.

Dimensions.—Length, 5.6 cm.; width, 2.6 cm. (fragment); thickness, 0.6 cm. in center, tapering to thin edge.

Sticks Bound Together

SHORT AND LONG STICKS (FIG. 165, *c*)

Technique.—Unworked twigs.

Shape.—Short stick bound to end of long stick with fiber binding.

Occurrence by Phases, Tularosa Cave.—Pine Lawn, 1; San Francisco-through-Tularosa, 1.

Dimensions.—Length of short stick, 5.5, 7.0 cm.; length of long stick, 10.0, 16.0 cm.

SPLIT STICKS (FIG. 165, *d*)

Technique.—Straight sticks; split in two; bark remains.

Shape.—Bound loosely together with fiber at one end; flat sides facing one another.

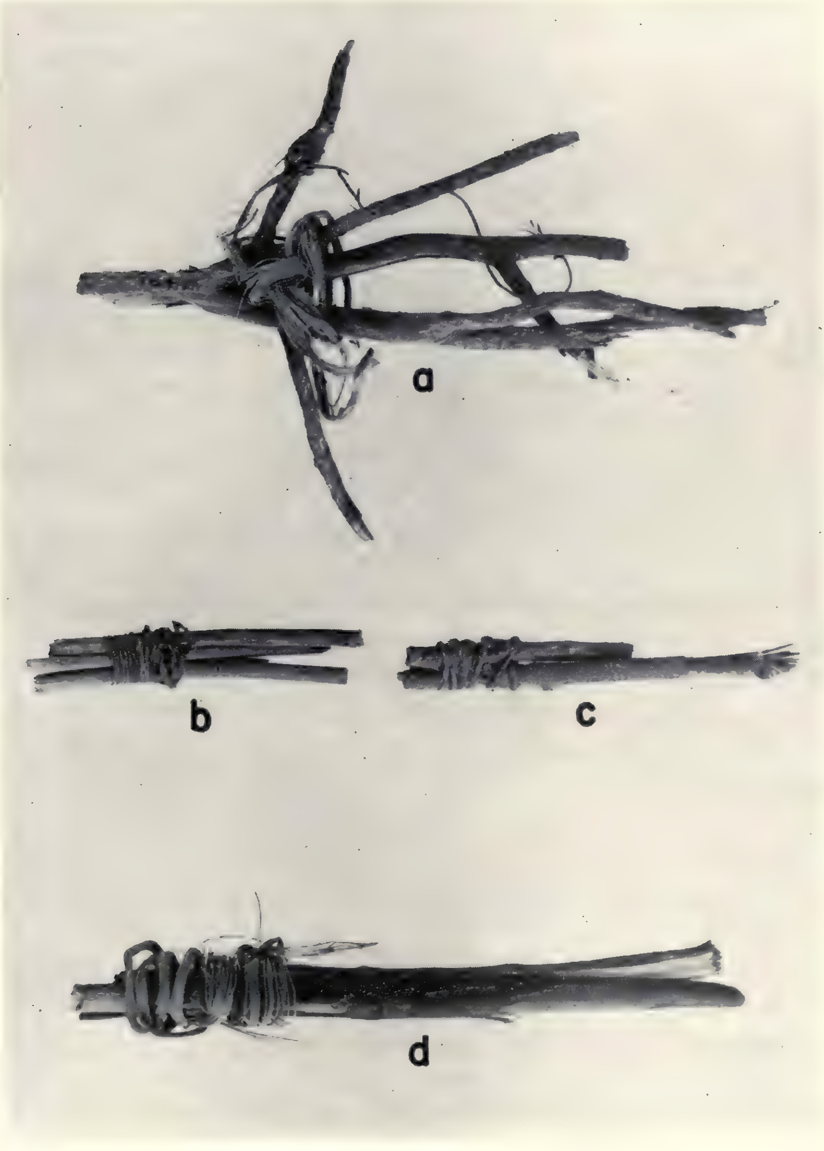

FIG. 165. Sticks bound together: *a*, branches; *b*, bundle; *c*, short and long sticks; *d*, split sticks. Length of *a*, 14.7 cm.

Occurrence by Phase, Tularosa Cave.—Pine Lawn, 1.

Occurrence by Phase, Cordova Cave.—Late, 1.

Dimensions.—Length, 17.0, 8.5 cm.; width, 1.0, 1.1 cm.; thickness, 1.0, 1.5 cm.

COILED BINDING

Technique.—Same as above.

Shape.—Bound together with coiled fiber.

Occurrence by Phase, Tularosa Cave.—Pine Lawn, 1.

Dimensions.—Length, 5.5 cm.; diameter, 0.5 cm.

PLAIN

Technique.—Unworked twigs.

Shape.—Sticks bound together at one end with loose fiber binding; opposite ends charred.

Occurrence by Phase, Tularosa Cave.—San Francisco-through-Tularosa, 1.

Dimensions.—Length, 14.7 cm.; width, 2.0 cm.; thickness, 1.0 cm.

BRANCHES (FIG. 165, *a*)

Technique.—Unworked branching twigs.

Shape.—Bound together with fiber wrapped loosely around forks in branches.

Occurrence by Phase, Tularosa Cave.—San Francisco-through-Tularosa, 1.

Dimensions.—Length, 16.7 cm.; diameter, 0.7 cm. at base.

BUNDLE (FIG. 165, *b*)

Technique.—Twigs; bark peeled off.

Shape.—Bundle of five twigs; bound together with twisted fiber cord passing around bundle several turns; free end passed under last turn and pulled tight; excess length hangs free with knot in end of cord.

Occurrence by Phase, Tularosa Cave.—San Francisco-through-Tularosa, 1.

Dimensions.—Length, 8.4 cm.; width, 1.2 cm.; diameters of individual sticks, 0.4 cm.

Curved Worked Twig

Technique.—Naturally curved stick; bark remains except on one end; carving used to reduce diameter at end.

Shape.—Curved stick with slightly tapered end.

Occurrence by Phase, Tularosa Cave.—Pre-Pottery, 1.

Occurrence by Phase, Cordova Cave.—Pre-Pottery, 1.

Dimensions.—Length, 12.3, 7.5 cm.; diameter, 1.1, 0.8 cm.

Stake

Technique.—Short, heavy stick; bark remains; whittled.

Shape.—Cylindrical cross section; tapers to point on one end; opposite end roughly cut at right angles to long axis.

Occurrence by Phase, Tularosa Cave.—San Francisco-through-Tularosa, 1.

Dimensions.—Length, 20.5 cm.; diameter, 2.0 cm.

Rasp(?)

Technique.—Ends broken off roughly; bark removed.

Shape.—Straight stick with three scalloped depressions in one side, leaving projections at evenly spaced intervals. Flat side and one projection charred.

Occurrence by Phase, Cordova Cave.—Late, 1.

Dimensions.—Length, 16.0 cm.; width, 1.8 cm.; thickness, 1.2 cm. (1.8 cm. at projections).

Bundle of Sticks (Stock Material)

Technique.—Unworked sticks; bark remains; ends broken off.

Shape.—Bundle of eight sticks.

Occurrence by Phase, Tularosa Cave.—Pine Lawn, 1.

Dimensions.—Length, 27.0–63.0 cm.; diameter, 1.2 cm.

Charred, Shouldered, Pointed Sticks (Fig. 148, e, f)

Technique.—Burned or carved to shape; surfaces smoothed.

Shape.—Short fragment of wood, tapering from shoulder to rounded, charred point.

Occurrence by Phases, Tularosa Cave.—Georgetown, 1; San Francisco, 1; San Francisco-through-Tularosa, 3.

Dimensions.—Length, 5.0–22.0 cm.; width, 1.2–2.5 cm.; thickness, 1.0–1.5 cm.; length of point, 1.5–3.0 cm.

J-Shaped Split Stick

Technique.—Straight stick; split; bark removed; cracked and bent to shape.

Shape.—Cracked and bent in two places to form a J-shape with right-angled corners.

Occurrence by Phase, Cordova Cave.—Pre-Pottery, 1.

Dimensions.—Thickness, 0.5 cm.; width, 1.0 cm.; length of back, 5.8 cm.; length of bottom, 2.5 cm.; length of front, 3.0 cm.

Reed Tubes

SHORT TUBES

Technique.—Sections of reed; ends cut off squarely at right angles to long axis.

Shape.—Tubes, open at both ends; two specimens with nodes remaining, nodes at end of tube, one node pierced, one intact.

Decoration.—One specimen with 6.0 cm. strip of outer surface peeled off one end.

Material.—Reed (*Phragmites communis*).

Occurrence by Phase, Tularosa Cave.—Pine Lawn, 1 (node, septum pierced; peeled at end); Georgetown, 1; San Francisco, 2; San Francisco-through-Tularosa, 2 (one with node, septum intact).

Dimensions.—Length, 3.1–11.4; diameter, 0.8–1.0.

LONG TUBES (FIG. 148, *a*)

Technique.—Reed without nodes; ends cut off squarely at right angles to long axis.

Shape.—Indistinct marks of sinew(?) binding at intervals; hollow tube.

Material.—Reed.

Occurrence by Phase, Tularosa Cave.—San Francisco-through-Tularosa, 1.

Dimensions.—Length, 42.0 cm.; diameter, 1.0 cm.

Fiber-Capped Reed (Fig. 148, d)

Technique.—Section of reed; one end splintered; opposite end crimped.

Shape.—One end of reed crimped and closed just above a node; fibers loop over crimped end, extend down one-half length of reed, bend around reed and return to loop over crimped end from other side; pattern repeated with two parallel and two crossed fibers on opposite sides of reed; binding forms a loose cap over crimped end of reed.

Material.—Reed (*Phragmites communis*).

Occurrence by Phase, Tularosa Cave.—Pre-Pottery, 1.

Dimensions.—Length, 10.5 cm.; diameter, 0.8 cm.

Worked Cane

Technique.—Section of cane; split in two; whittling marks on end; smoothed.

Shape.—Plano-convex cross section; one end rounded.

Material.—Cane.

Occurrence by Phase, Tularosa Cave.—San Francisco-through-Tularosa, 1.

Dimensions.—Length, 50.3 cm.; width, 2.8 cm.; thickness, 1.1 cm.

Corn Cob Pottery Smoother (Fig. 149, j)

Shape.—Corn cob filled with hardened clay; three flat sides.

Material.—Corn cob; clay.

Occurrence by Phase, Tularosa Cave.—Pine Lawn, 1.

Dimensions.—Length, 5.5 cm.; diameter, 2.0 cm.

Worked Gourd Fragments

VESSEL (FIG. 166)

Shape.—Neck of gourd cut away to leave round opening; gourd body flares out below mouth; fragment.

Remarks.—Three fragments; two fragments from one phase, one from succeeding phase; contiguous levels in same square.

Material.—Gourd (*Lagenaria* sp.).

Occurrence by Phase, Tularosa Cave.—Pre-Pottery–Pine Lawn, 1 vessel (3 sherds).

Dimensions.—Diameter of mouth, 6.0 cm.

TRIANGULAR FRAGMENTS (FIG. 167, *a*, *f*)

Material.—Gourd (*Lagenaria* sp.).

Occurrence by Phase, Tularosa Cave.—Pre-Pottery, 1; San Francisco, 1 (2 holes, 0.2 cm. diameter, near one edge).

Dimensions.—Sides, 6.4×4.6×4.6, 2.6×2.6×2.6 cm.; thickness, 0.8, 0.3 cm.

RECTANGULAR FRAGMENTS (FIG. 167, *b*, *g*)

Shape.—Pine Lawn specimen: two corners scalloped, three holes evenly spaced along short edge, fiber fragments in two holes. San Francisco specimen: hole near one edge, fiber drawn through hole, passed around edge of gourd and tied in place.

Material.—Gourd (*Lagenaria* sp.).

Occurrence by Phase, Tularosa Cave.—Pine Lawn, 1; San Francisco, 1.

Dimensions.—Length, 8.0, 3.0 cm.; width, 5.4, 1.9 cm.; thickness, 0.5, 0.2 cm.

CURVED FRAGMENT (FIG. 167, *d*)

Shape.—Fragment of curved edge; side opposite curve has three small holes near the edge.

Material.—Gourd (*Lagenaria* sp.).

Occurrence by Phase, Cordova Cave.—Plain Ware, 1.

Dimensions.—Length, 4.5 cm.; thickness, 0.4 cm.

SEMI-CIRCULAR FRAGMENTS OF RINGS (FIG. 167, *c*)

Shape.—Ring with central hole broken across diameter; only one half remains.

Material.—Gourd (*Lagenaria* sp.).

Occurrence by Phase, Tularosa Cave.—Georgetown, 1.

Occurrence by Phase, Cordova Cave.—Pre-Pottery, 1.

Dimensions.—Diameter, 4.0 cm.; thickness, 0.2 cm.

DISKS (SPINDLE WHORLS?)

Shape.—Portion of disk with central perforation.

Material.—Gourd (*Lagenaria* sp.).

Occurrence by Phase, Tularosa Cave.—Georgetown, 1.

Occurrence by Phase, Cordova Cave.—Pre-Pottery, 1.

Dimensions.—Diameter of disks, 3.6 cm.; thickness, 0.4 cm.; diameter of holes, 0.3 cm.

PENDANT (FIG. 167, *e*)

Shape.—Oval pendant with perforation in center near top.

Material.—Gourd (*Lagenaria* sp.).

Occurrence by Phase, Tularosa Cave.—Unplaced, 1.

Dimensions.—Length, 4.4 cm.; width, 3.4 cm.; thickness, 0.1 cm.

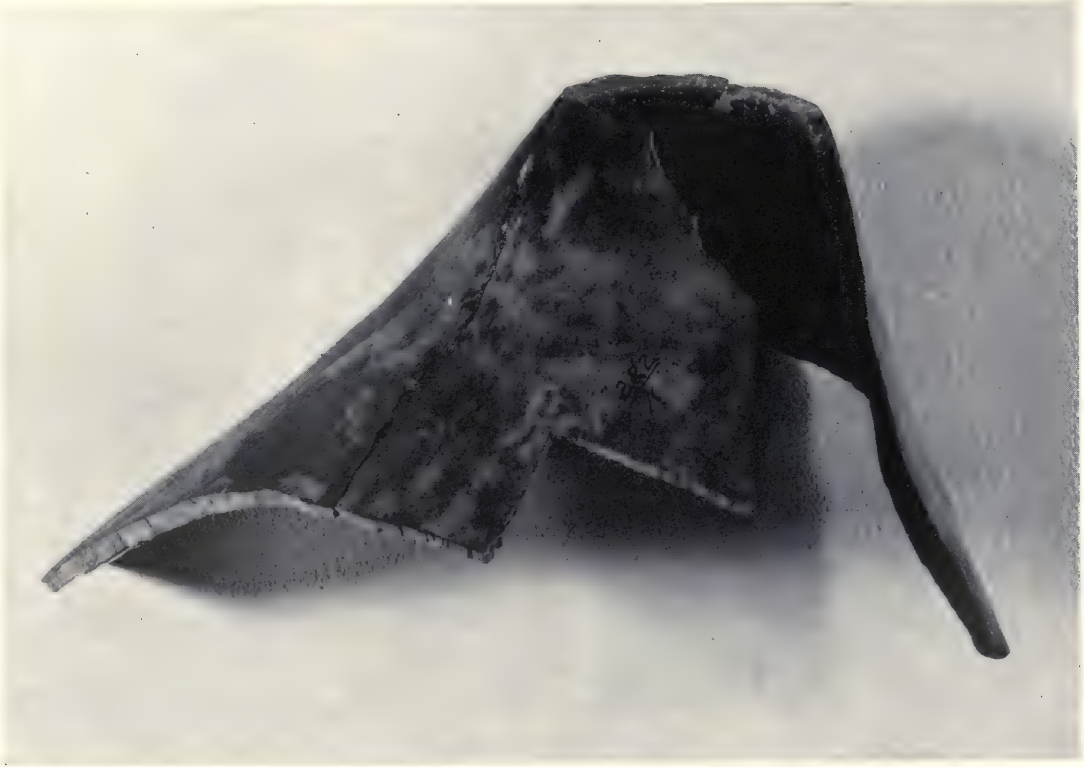

FIG. 166. Gourd vessel. Diameter of mouth, 6 cm.

Worked Wood Fragments

Technique.—Pieces of wood which show various woodworking marks; none identified as artifacts; presumably incomplete or discarded stock material.

Occurrence by Phase, Tularosa Cave.—Pre-Pottery, 27; Pine Lawn, 14; Georgetown, 12; San Francisco, 18; San Francisco-through-Tularosa, 22; Reserve-through-Tularosa, 5; unplaced, 12.

Occurrence by Phase, Cordova Cave.—Pre-Pottery, 72; Plain Ware, 35; Late, 130.

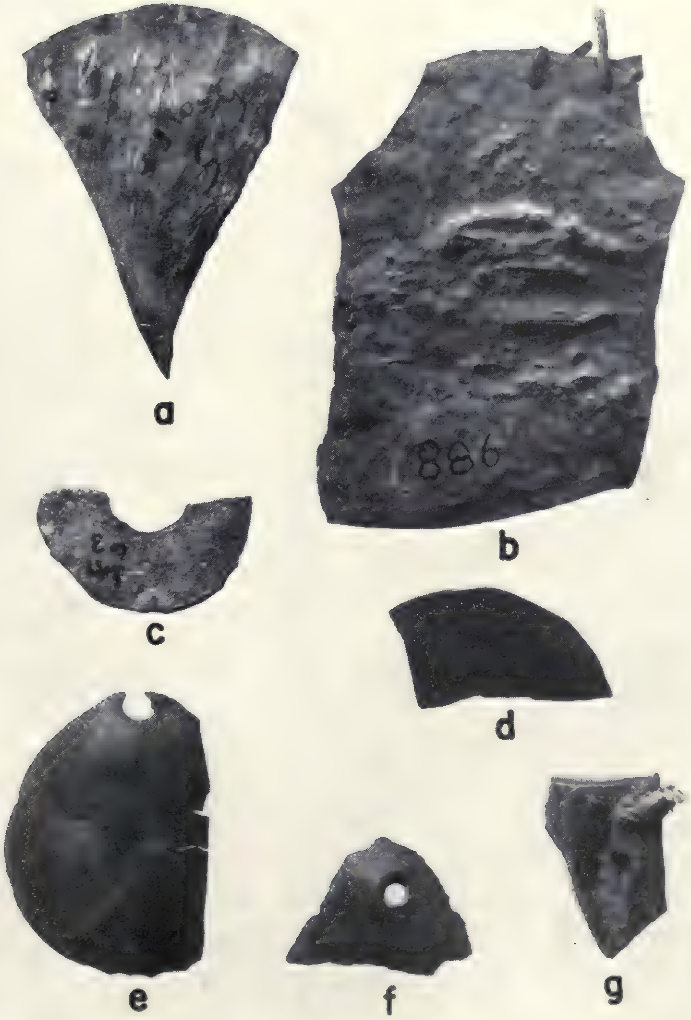

FIG. 167. Worked gourd fragments. *a*, *f*, triangular fragments; *b*, *g*, rectangular fragments; *c*, fragment of ring; *d*, curved fragment; *e*, pendant. Length of *b*, 8 cm.

VIII. Miscellaneous Specimens

By PAUL S. MARTIN

Medicine Man's Bag or Charm Bag (Fig. 168)

Part of muskrat skin, rolled and sewed up at one end to make a bag. When found, opening was tied with yucca cord. Contents include four obsidian flakes, four quartz crystals, three unworked pieces of quartz, three curiously shaped concretions that resemble worms or snails, two front toes and one hind toe of the great horned owl, the head and horn of the rhinoceros beetle (*Dynostes granti*), and thirty pieces of vegetable matter. These have not been finally identified but may include a few unworked twigs, sagebrush root, cough root (*Ligusticum porteri*), several nuts, a gall, one small piece of unworked wood 2 cm. long by 0.5 cm. in diameter, perforated for suspension, and one fruit (wild currant?) also perforated for suspension.

Occurrence by Phase, Tularosa Cave.—San Francisco-through-Tularosa, 1.

Dimensions.—Length of bag, 25.2 cm.

Bag

Piece of bison skin sewed together to form a bag. Bag filled with about one pound of squash or pumpkin seeds (*Cucurbita pepo*).

Occurrence by Phase, Tularosa Cave.—Georgetown, 1.

Dimensions.—Length of bag, 20.9 cm.

Leather Bags(?) or Quivers

Fragments of deer hide, tanned, fairly soft, with leather thongs threaded through perforations in hide. Thongs are either for binding together two pieces of leather or for drawstrings.

Occurrence by Phases, Tularosa Cave.—Pre-Pottery, 2; San Francisco, 1.

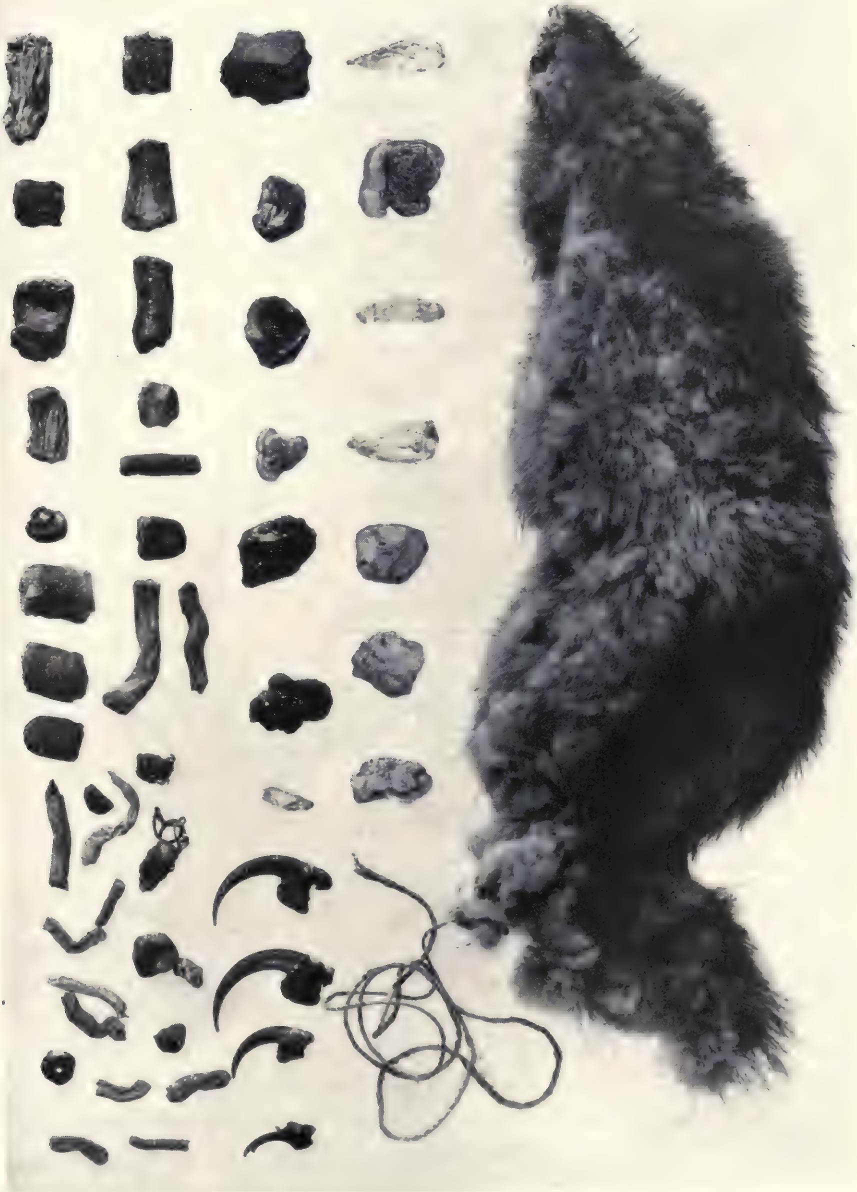

FIG. 168. Medicine man's muskrat skin bag with contents spread out. Length of bag, 26 cm.

Fragments of Leather

Use uncertain; may have been parts of clothing.

Material.—Deer skin.

Occurrence by Phases, Tularosa Cave.—Pine Lawn, 2; Georgetown, 1; San Francisco-through-Tularosa, 1.

Charm

Folded piece of deer hide (inside of which is small piece of fur) wrapped with yucca cord.

Occurrence by Phase, Tularosa Cave.—San Francisco, 1.

Dimensions.—Length, 3.0 cm.; width, 3.0 cm.; thickness, 1.8 cm.

Deer Hoof Charms or Pahos

Three sets of two or three deer hoofs impaled on small twigs.

Occurrence by Phases, Tularosa Cave.—Pine Lawn, 1; Georgetown, 1; San Francisco, 1.

Dimensions.—Lengths, 3.9, 4.8, and 7.5 cm.

Ring

Small ring made of a circlet of twig and wrapped with fiber.

Occurrence by Phase, Tularosa Cave.—San Francisco, 1.

Dimensions.—Diameter, 1.5 cm.

Ornament(?)

Femora (14) of fig beetle (*Catinis* sp.?) strung on fine yucca thread.

Occurrence by Phase, Tularosa Cave.—San Francisco-through-Tularosa, 1.

Dimensions.—Length, 6.5 cm.

Ornaments

Puccoon seeds (*Lithospermum multiflorum*) pierced by cactus spine. Nine seeds on one spine, four on another.

Occurrence by Phases, Tularosa Cave.—Georgetown and San Francisco-through-Tularosa, 1.

Occurrence by Phase, Cordova Cave.—Late, 1.

Dimensions.—Length, 4.5 and 2.5 cm.

Reed Bead

Short tubular section of reed (*Phragmites communis*) 2.3 cm. long, strung on a 2-yarn, Z-twisted hard fiber cord.

Occurrence by Phase, Tularosa Cave.—Georgetown, 1.

Leather Beads

A series of leather disks, 1 cm. in diameter, strung on a double 2-yarn Z-twisted hard fiber cord that is tied at intervals with overhand knots.

Occurrence by Phase, Tularosa Cave.—Pre-Pottery, 1.

Corn Husk Pendant

Segment of corn husk 9.5 cm. long, hanging from the end of a 2-yarn, Z-twisted hard fiber cord. The cord is tied around the middle of the corn husk with an overhand knot.

Occurrence by Phase, Tularosa Cave.—Georgetown, 1.

Yucca Pendant

A strip of yucca is folded in half over another strip that loops around the first. The free ends of the second strip are split and twisted into a two-yarn cord and tied together with a square knot to form a loop, 3.5 cm. long, from which the pendent strip (4.5 cm. long) is suspended.

Occurrence by Phase, Tularosa Cave.—Pre-Pottery, 1.

Zigzag Folded Ornament

Two flat narrow strips of corn husk, about 1.2 cm. wide, are held together at one end. A short distance from the end each is turned in toward the other and folded at a 90 degree angle. Each end is then folded in turn around itself and the other strip.

This twisted "knot" is repeated at 3.0 cm. intervals down the length of the corn husk strip, producing a flat zigzag ornament 11.5 cm. long and 3.0 cm. wide.

Occurrence by Phase, Tularosa Cave.—Pine Lawn, 1.

Feather Ornaments

A. A series of twelve 2-yarn cords tied with lark's head knots to an area of 3.2 cm. along a 2-yarn Z-twisted hard fiber cord. A feather quill is bent over the ends of two of the pendent strings and secured with a single yarn hard fiber binding.

Occurrence by Phase, Tularosa Cave.—San Francisco-through-Tularosa, 1.

B. Mass of fine, wild turkey feathers tied in a fan-shape with yucca string.

Occurrence by Phase, Tularosa Cave.—San Francisco, 1.

Dimensions.—Length, 14 cm.

Feathers (Unworked)

Mass of loose feathers of wild turkey. Five quills of wild turkey and one feather from scarlet macaw (*Ara macao*), the present range of which is southern Mexico. It does not occur north of the heavy rain forest in Tamaulipas.

Occurrence by Phases, Tularosa Cave.—San Francisco-through-Tularosa, 6.

Brushes

Bundles of grass bound in middle with yucca cord.

Occurrence by Phase, Tularosa Cave.—Pine Lawn, 1; San Francisco-through-Reserve, 1.

Dimensions.—Length, 47 cm. and 35 cm.

Rests for Pots or Baskets

Coiled bundles of grass, grasses and rushes, or yucca, loosely and carelessly put together. No variation from early to late.

Occurrence by Phases, Tularosa Cave.—Pre-Pottery, 3; Georgetown, 2; San Francisco-through-Tularosa, 1.

Occurrence by Phase, Cordova Cave.—Late, 1.

Dimensions.—Diameter, 13.3–20 cm.; thickness, 1.5–3.2 cm.

Materials for Basket-Making(?)

Four bundles of split fibers found tied together in neat bundles. Evidently, small twigs were split three ways and produced a bark splint, a withe or next inner portion of twig minus bark, and a splint from near center of twig. Probably used for basket-weaving or similar work. This guess is strengthened by the fact that two excellent bone awls were tucked in the end of one bundle.

Material.—Willow (*Salix* sp.).

Occurrence by Phases, Tularosa Cave.—Pre-Pottery, 1; Georgetown, 2; San Francisco, 1.

Dimensions.—Length, 44–100 cm.

Wickerwork Fragment

A strip of yucca leaf is bent in a U-shape, forming two warps. Another strip is woven back and forth across it for 4.1 cm. Warp ends extend beyond.

Occurrence by Phase, Cordova Cave.—Pre-Pottery, 1.

Dimensions.—Length, 12.0 cm.; width, 3.0 cm.

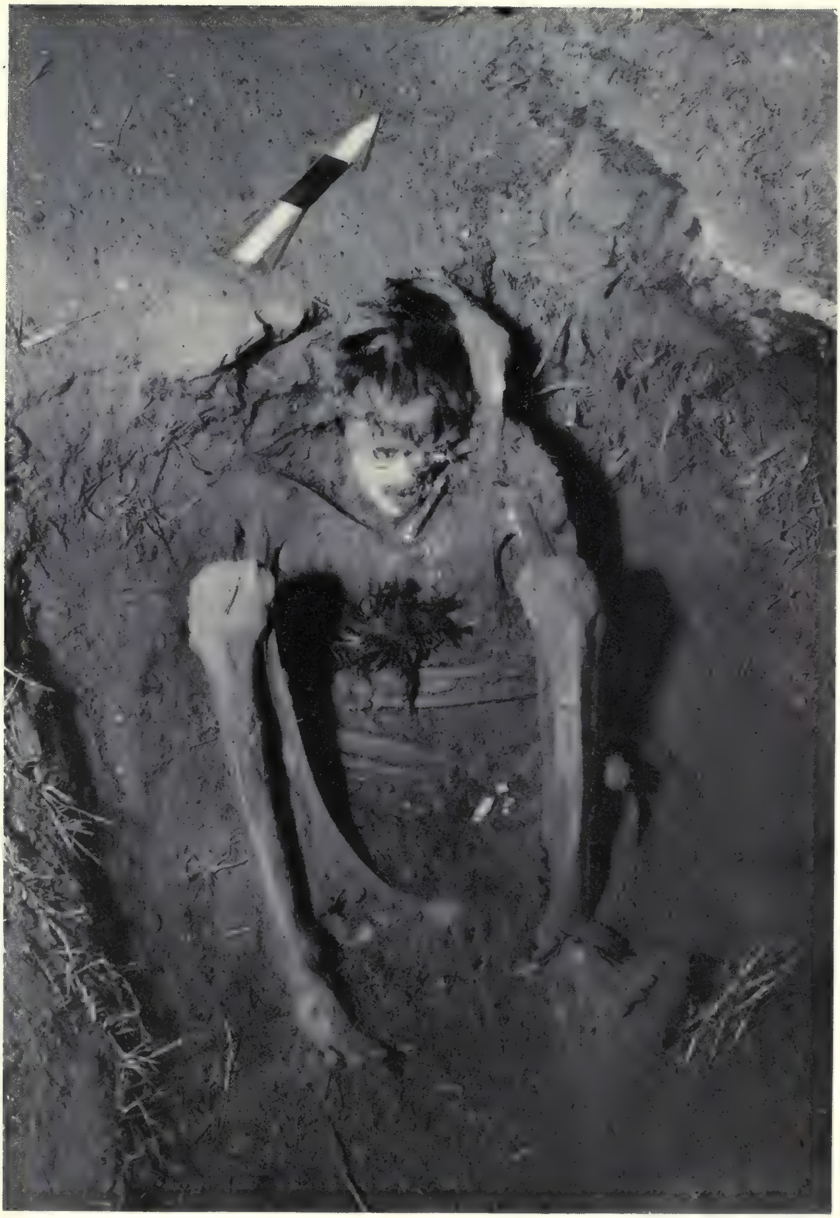

FIG. 169. Desiccated burial No. 1, male, Tularosa Cave. Arrow (30 cm. long) points north.

IX. Burials in Tularosa Cave

By PAUL S. MARTIN

Two desiccated burials were recovered from Tularosa Cave, and Hough (1914, p. 132) had found others.

Both were interred in the Plain Ware Horizon (burial No. 1 in Georgetown Phase; burial No. 2 in Pine Lawn Phase), although the graves had been dug down to the floor of the cave through the Pre-Pottery Horizon. Sherds of Alma Plain and San Francisco Red were associated with both burials.

Since only plain ware was found with these "mummies," we have assigned the interments to the Pine Lawn–Georgetown phases (A.D. 1–600).

The Indians continued to occupy the cave after the interments had been made. We found the same kind of evidence in pit-houses at the SU site. Several sub-floor burials were located and because the burial pits had been smoothed over, we assumed that the people continued to live there. This custom has been reported before (Cosgrove, H. S. and C. B., 1932, p. 23; Martin, 1940, p. 88).

The burials of Tularosa Cave were found near the rear of the cave; those reported by Hough were found near the front.

Both burials rested on grass beds or nests. Burial 1, a male, lay or sat on deer or antelope hide; a feather bundle on a stick was lying on the chest. The hair had been cropped short. Orientation was toward the south—toward the mouth of the cave (Fig. 169).

Burial 2, a female, wrapped in a rabbit fur(?) blanket, lay on a rush mat. Tied around the waist of the body, with the tie on the left side, was a string apron. Near the feet lay a coil of fiber for basket-making(?). The hair had been cropped short (shorter than that of burial 1). Orientation was towards the southwest (Fig. 170).

The legs of both were tightly flexed (though not bound to the body) and the arms folded across the chest. The burial position of both was similar—half reclining, half seated—and was similar to the burials at the SU Site.

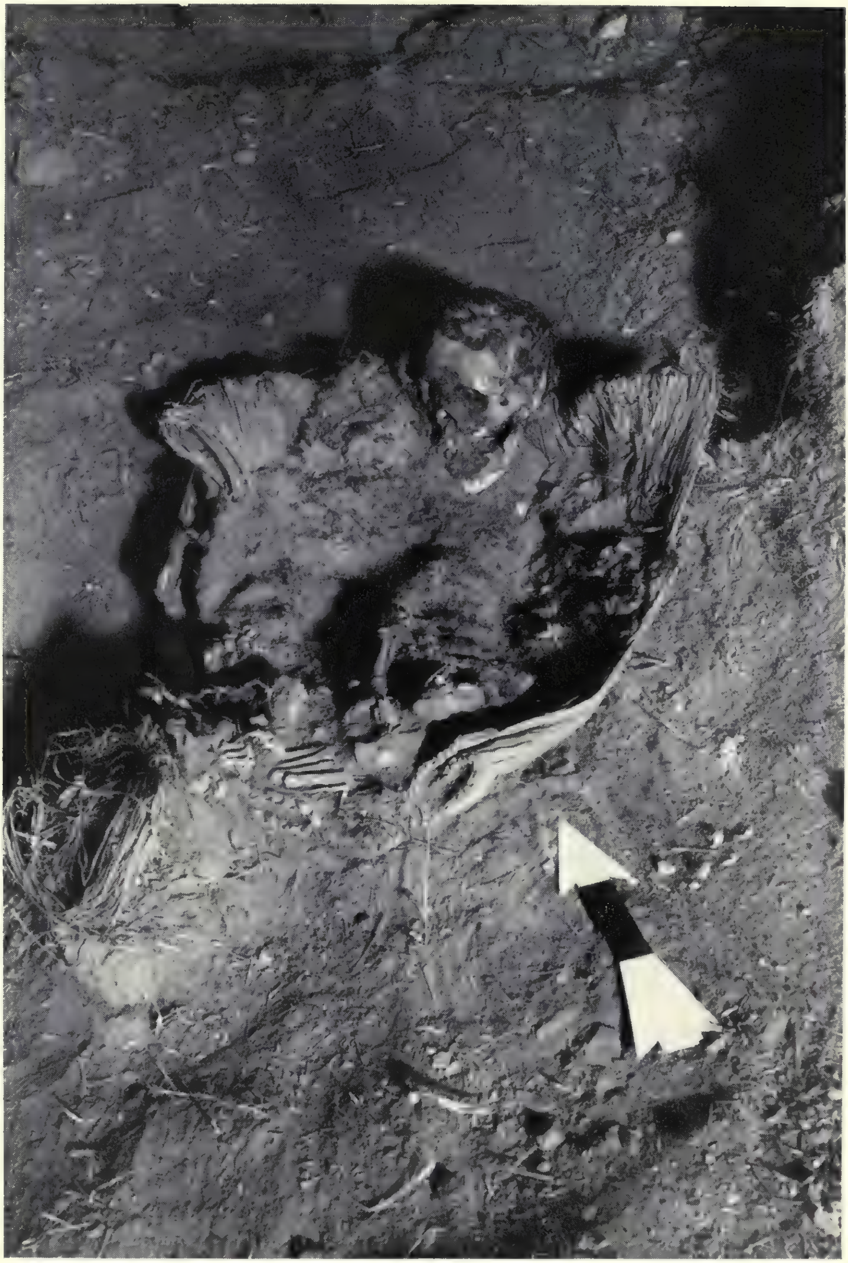

FIG. 170. Desiccated burial No. 2, female, wrapped in fur blanket and resting on rush mat, Tularosa Cave. Arrow (30 cm. long) points north.

X. A Preliminary Survey of Plant Remains of Tularosa Cave

By Hugh C. Cutler

The vegetal remains from Tularosa Cave are exceptionally valuable because the amount from each level is large enough to be statistically significant, nearly all is well preserved, and the site was occupied over a long period. So important are these remains in the outlining of a history of several cultivated plants and of the plant utilization pattern for the region that they will be treated in detail in a separate volume to be published in the Botanical Series of Fieldiana. This work is being aided by a grant from the Wenner-Gren Foundation.

Plant remains are similar in many respects to potsherds. A single specimen is of little significance. It may have been brought to the site by accident; it may have been buried in an old layer or brought to a recent one by rodents, pot hunters, or an occupant of the site. Like the kinds of materials in pottery, the kinds of plants of any area are largely determined by the ones available in the region. And like pottery, new varieties can come from other regions or changes can be effected by human manipulation, by selection in the case of plants. But unlike pottery, plants are changed by the environment, and by accidents or mutations in the plants themselves. And the number of variables in plants is so much greater than in pottery that a far larger sample is usually required before an accurate study can be made.

Unfortunately, most sites yield relatively few plant remains and for this reason most reports on them have consisted of little more than identifications—disconnected names of less value to most readers than unidentified pictures of the specimens themselves. There is a growing number of studies on the origin, development, and dispersal of plants used by man, and botanists are able to provide more information in their reports on the specimens they receive. Unfortunately, some archaeologists save only a portion of

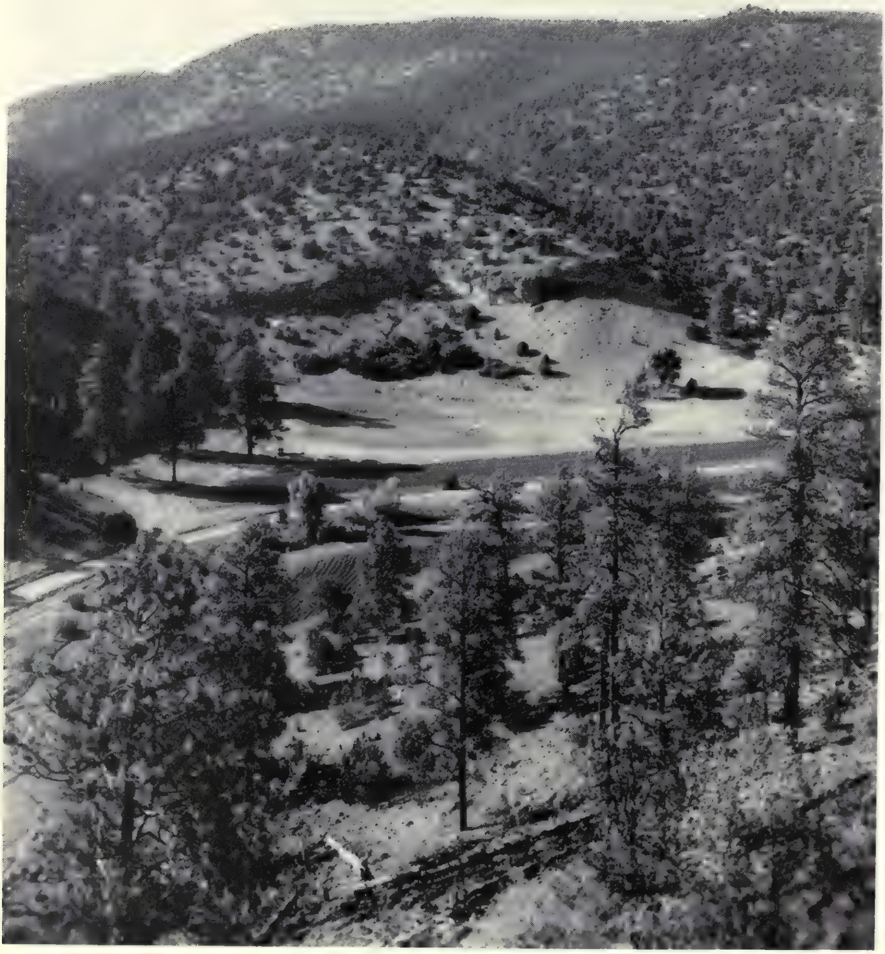

FIG. 171. View showing fields on flat beside stream; Tularosa Cave in background.

the plant material in the sites they excavate and of this, send only samples to the botanists, often with so little information on the sequence or relative age of the materials that the specimens cannot be arranged in any sort of order. Little wonder that very few botanists have been interested in such remains or prompt in their reports.

In Tularosa Cave the plant material was abundant, well preserved, and excavated with care. While the identifications are of value in documenting the occurrence of a particular plant in any level of the site, the most important contribution is the evolution of the cultivated plants and of the entire plant complex used by the cave dwellers.

The Environment

Tularosa Cave lies in what Kearney and Peebles (1942) call the Western Xeric Evergreen Forest. Juniper, pinyon, and ponderosa pine are the most prominent trees on the slopes and beneath them and on the flats below the cave grow many of the characteristic grasses of western New Mexico and central Arizona (Fig. 171). Overgrazing and deforestation have caused considerable loss of soil by erosion. The perennial stream is probably more entrenched than it was at the time the cave was occupied and the proportions of the grasses have been radically changed. *Poa Fendleri,* for example, is one of the most common grasses found in the cave, yet it is found only occasionally about the cave today. So far no plants found in the cave can be interpreted as indicating a different environment than that existing today. Corn, beans and some squash are still planted on the flats on both sides of the stream below the cave, and while cotton is not grown in the immediate vicinity, it probably would grow if the right varieties were planted. Yuccas still can be found, the cylindrical cactus is frequent, and the wild gourd is a perennial weed in fields and along the roadside although it is seldom found in undisturbed areas.

The Cultivated Plants

Of the five cultivated plants, corn is the most useful for study. The ears are often brought back to the dwellings to eat while green or to store the grain on the cob. The cob is often cast aside in the refuse heaps and is so durable that even after it has been burned and broken it still exhibits enough characteristics to give a good picture of the kind of corn grown. Squash is less favorable for study for the rind tells very little, the seeds are often eaten, and the stem is often left in the field. In the case of beans, the seeds are usually brought back to the dwelling, for the dry beans were probably threshed and winnowed in the fields as is done by many Indian groups today. Only a few beans escaped the pot and these, together with a few pods, constitute our only source of information. For the bottle gourd (*Lagenaria*), the dried shell of broken gourds is usually the only part found, and for cotton there is seldom more than the fiber. The cultivated plants found are most like the assemblage described by Carter (1945) as typical of the Hohokam Area.

Zea mays L., corn. More than 30,000 cobs, many of them intact except for grains, some ears with a few to nearly all the grains, ear shanks and husks, tassel fragments, pieces of roots, stalks, and leaves form the greatest part of the vegetal material. In this survey only the cobs are listed because these contain several readily classified characters. Ears in the lower levels are frequently ovoid or pineapple-shaped but often cylindrical and straight while those in the upper levels are practically always slender and cylindrical (Fig. 172). I interpret the pineapple shape as a primitive form, not far removed from the earliest domesticated ears. It recalls some of the prehistoric and modern ears from South America (Cutler, 1946). Like the ears, the glumes of the tassels from the lowest and earliest levels are similar to those from South America while tassels from later levels are quite distinct.

Ears from the lower levels have slightly larger glumes than those from later deposits, as Mangelsdorf and Smith (1949) found in their

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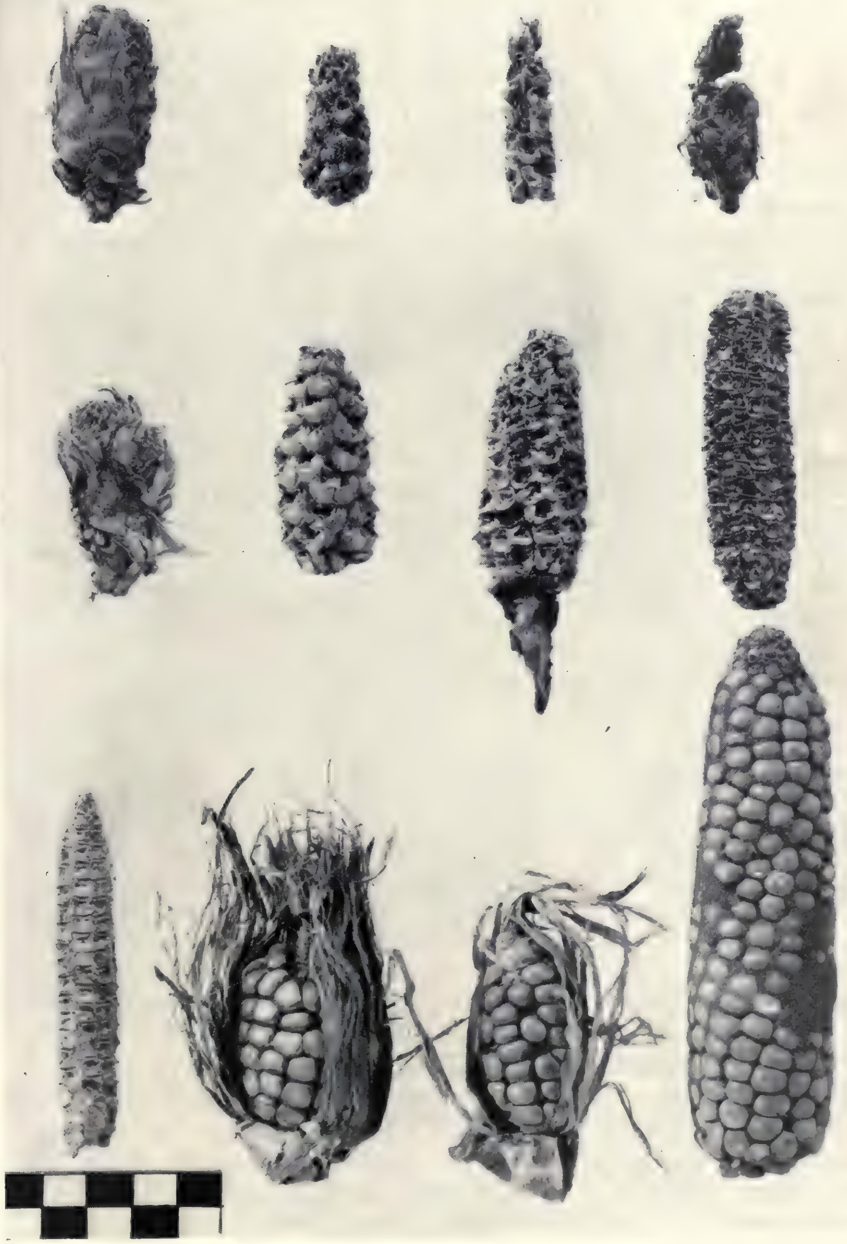
FIG. 172. Corn from Tularosa Cave (scale in centimeters):

Top row, left to right:
- Square 3R2, Level 9, teopod ear with grains.
- Square 2R1, Level 13, cob with staminate spikelets.
- Square 6R1, Level 7, cob with staminate spikelets.
- Square 2R1, Level 13, pod corn(?).

Middle row, left to right:
- Square 2R2, Level 9, pod corn(?).
- Square 2R2, Level 9, tripsacoid ear with hard cob and glumes.
- Square 2R2, Level 8, pineapple-shaped ear found mainly in lower levels.
- Square 2R2, Level 14, fourteen-rowed cob typical of lower levels.

Lower row, left to right:
- Square 2R1, Level 6, eight-rowed cob typical of later levels.
- Square 2R2, Level 10, ear with husks, from Pre-Pottery Phase.
- Square 2R2, Level 10, ear with husks, from Pre-Pottery Phase.
- Square 3R2, Level 11, large ear with grains, from Pre-Pottery Phase.



material from nearby Bat Cave. Considerable importance usually has been attached to pod corn, ears with glumes so long that they cover the grains in extreme cases, because of its supposed resemblance to primitive corn. Unfortunately, several genes produce effects which superficially resemble pod corn and for each of these, as well as for the various kinds of pod corn, there are numerous modifiers. Five examples from Tularosa Cave are of interest in this connection (Fig. 172). The best of these, from the Pine Lawn Phase, has the paired spikelets subtended by a single well-developed bract as in the case of Singleton's corn grass and the mutant known as teopod (Cutler and Cutler, 1948). This ear is in excellent condition and all grains are still present. One of the spikelets appears to have the secondary flower developed, an occurrence frequently associated with the pod, teopod, and corn grass genes. A cob from the Pre-Pottery Phase has many spikelet pairs which consist of one pistillate or grain-bearing spikelet and one staminate or pollen-bearing spikelet. While the glumes of the pistillate spikelets are hard and only slightly elongated, those of the staminate spikelets are papery and large enough to give a suggestion of a battered ear of pod corn. Another cob from the Pre-Pottery Phase has this same arrangement. A cob from the Pre-Pottery Phase and one from the Pine Lawn Phase which appear to be pod corn will not be dissected until a technique which is less destructive than the ones now used is devised.

Probably the most readily observed character of the corn cob is the number of rows of grains or kernels. This is best counted about one-quarter to one-third the distance from the base to the tip of the ear. The rows of kernels are usually borne on paired spikelets, although the spikelets may rarely be found grouped in threes or one of the pairs may not develop. Thus the total number of rows of grain on an ear is practically always an even number. When the total number of rows of spikelets (or kernels) on an ear is an even number of pairs, the rows are usually in a straight line, but when the number is an odd number of pairs, the rows generally have a slight twist. Some difficulty in counting the number of rows is introduced by spikelets or even rows of spikelets which do not develop grains. This usually occurs when environmental conditions are unfavorable and the vigor of the plant reduced. This may be the result of infertile soil, unsuitable amounts of water, competition with weeds and other plants, or of damage to the plant. It is significant that a large number of the ears in the lower and middle levels of Tularosa Cave have rows of undeveloped or aborted spikelets. These would have developed normally if conditions had been favorable and they

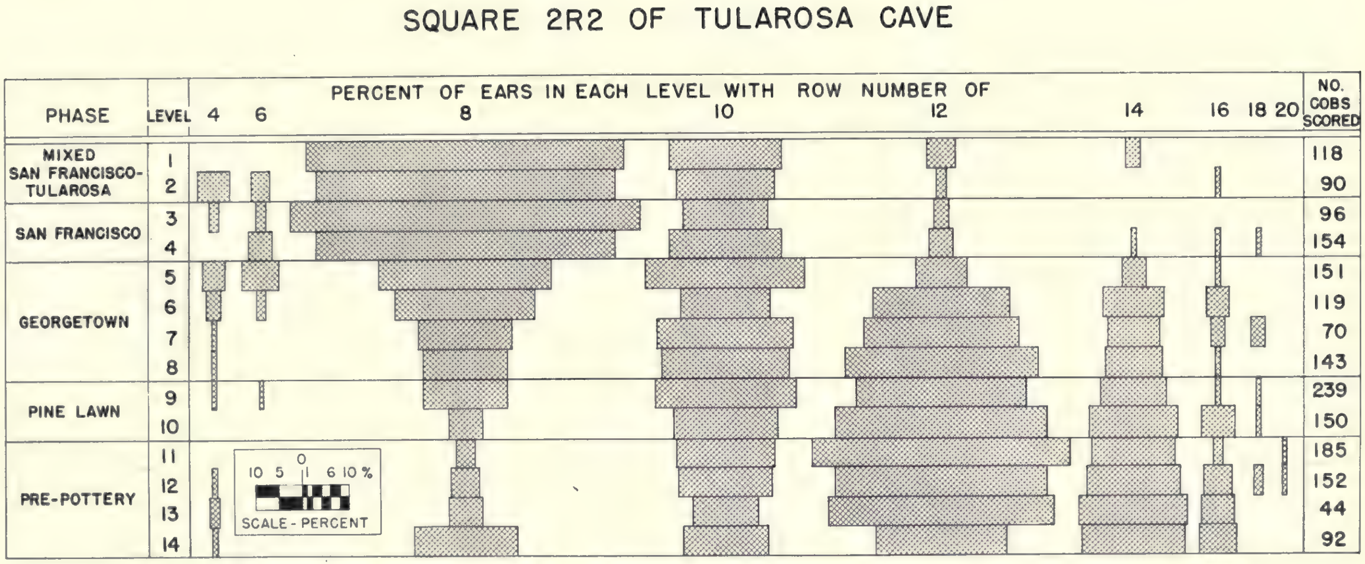


FIG. 173. Graph showing distribution of kernel-row numbers, Square 2R2, Tularosa Cave.

TABLE 3.—DISTRIBUTION OF KERNEL-ROW NUMBERS LISTED AS PERCENTAGES OF TOTAL COBS FOR EACH LEVEL

Square 2R2, Tularosa Cave

Level	Phase	4 rows	6 rows	8 rows	10 rows	12 rows	14 rows	16 rows	18 rows	20 rows	Number of cobs scored
1	San Francisco-through-Tularosa	.	.	68	24	6	3	.	.	.	118
2	San Francisco-through-Tularosa	7	4	64	21	2	..	1	.	.	90
3	San Francisco	2	2	75	18	3	..	.	.	.	96
4	San Francisco	.	5	64	24	5	1	1	1	.	154
5	Georgetown	5	8	37	34	11	5	1	.	.	151
6	Georgetown	3	2	30	19	29	13	5	.	.	119
7	Georgetown	1	.	20	29	33	11	3	3	.	70
8	Georgetown	1	.	18	27	41	12	1	.	.	143
9	Pine Lawn	1	1	18	30	36	14	1	1	.	239
10	Pine Lawn	.	.	7	22	45	19	7	1	.	150
11	Pre-Pottery	.	.	4	21	55	18	2	1	1	185
12	Pre-Pottery	1	.	6	20	45	20	6	2	1	152
13	Pre-Pottery	2	.	7	14	48	23	7	.	.	44
14*	Pre-Pottery	1	.	22	18	28	22	8	.	.	92

* Some of the larger cobs from this level were used in Carbon 14 dating and are not included in the cobs scored.

Square 3R2, Tularosa Cave

Level	Phase	4 rows	6 rows	8 rows	10 rows	12 rows	14 rows	16 rows	18 rows	20 rows	Number of cobs scored
3	San Francisco	4	6	53	24	11	1	1	.	.	453
4	San Francisco	1	8	52	20	14	4	1	1	.	198
5	Georgetown	2	6	44	23	18	3	3	.	.	231
6	Georgetown	1	1	20	21	39	10	5	2	1	104
7	Georgetown	.	1	14	18	53	10	4	1	.	387
8	Pine Lawn	1	1	7	23	45	17	6	1	1	457
9	Pine Lawn	1	.	6	15	52	18	7	2	.	629
10	Pine Lawn	1	.	4	15	46	23	9	1	1	618
11	Pre-Pottery	.	.	4	10	47	27	9	2	1	598
11 (pits)	Pre-Pottery	.	1	4	16	39	27	12	2	1	409

must be included in the kernel-row count the same as spikelets which have developed grains.

In Tularosa Cave corn there is a steady progression from higher to lower kernel-row numbers which may be interpreted as the result of selection of strains suited to the somewhat marginal environment. This change was probably accelerated by the gradual introduction of low kernel-row number varieties from outside the area. Low kernel-row numbers are characteristic of many tripsacoid varieties (Cutler, 1946) and the possibility of the change in Tularosa Cave being the result of the introduction of such varieties is supported by the greater number of ears with 4 and 6 kernel-rows in recent levels (Fig. 173; Table 3). Many tripsacoid varieties are extremely vigorous and resistant to drought so there would be an advantage to growing these varieties and hybrids of the older varieties of the region with the new ones.

The row numbers of cobs from the lowest levels of Tularosa Cave are significantly higher than those from Bat Cave, which has a mean of 10.7 rows for the lowest level. This suggests that the Tularosa Cave deposits are older; but there is a possibility that the less favorable conditions for preservation at Bat Cave resulted in a loss of the softer cobs of higher row number and the persistence of the more durable cobs usually associated with low row numbers. If this selective preservation occurred, Mangelsdorf and Smith's (1949) conclusion that other things being equal, the less tunicate, or podded, an ear of corn, the higher will be the number of rows on the ear, might need to be reversed.

The Georgetown Phase is characterized by a decrease in the amount of cultivated plant material present and by a significant increase in the amount of wild plant material (Table 4; Fig. 174). This may indicate that the population was smaller and more wild plants available for each individual of the population, or it may suggest that conditions for agriculture were not so favorable. In the first case there would be room for new migrants to the area, in the second there would likely be considerable movement throughout the Southwest in search of better homesites. In either case, these movements might bring in new varieties of corn as well as new customs and it is significant that a distinct change in row number, as well as in some cultural traits, occurs at the end of the Georgetown Phase. This change is so distinct in the corn that Square 3R2, Level 5, classified as Georgetown on the basis of pottery, can be shown on the basis of kernel-row number to be predominately

TABLE 4.—AMOUNTS OF CERTAIN PLANT REMAINS FOUND IN VARIOUS LEVELS

Square 2R2, Tularosa Cave

Phase	SF-T	SF	SF	G	G	G	G	PL	PL	P-P	P-P	P-P	P-P
Level	2	3	4	5	6	7	8	9	10	11	12	13	14
Corn cobs	90	96	154	151	119	70	143	239	150	185	152	44	92
Beans plus pods	..	..	4	3	1	1	4	..	..	..	1	1	1
Squash stems	..	1	..	..	..	..	3	1	3	..	..	1	..
Squash remains present	×	×	..	×	..	..	×	×	×	..	..	×	×
Lagenaria fragments	1	6	3	1	..	8	4	..	1	1	1	..	..
Cucurbita foetidissima roots	..	..	..	1	4	4	..	7	1	1	4	2	1
Cucurbita foetidissima pulp	..	..	1	1	11	8	3	1	..	..	..	..	..
Cucurbita foetidissima shell	1/8	1/16	1/2	1/2	6	2½	1½	1	1	1/2	1/8	1/16	1/4
Yucca pods	..	..	..	..	..	4	5	5	3	1	..	1	..
Echinocereus fragments	..	..	..	1	..	3	1	2	3	4	2	..	1
Oenothera bases	..	..	2	10	3	..	..	1	..	1	2	1	..
Thistle remains	..	..	..	2	15	3	2	1	1	1	1	1	..
Wads, corn husk	1	2	..	..	5	3	6	3	5	3	3	1	..
Wads, agave and yucca	..	..	..	4	4	4	2	3	3	1	..	..	1
Wads, grass stems	..	..	..	1	..	..	1	..	1	4	..	1	..

Square 3R2, Tularosa Cave

Phase	SF-T	SF	SF	SF	G	G	G	PL	PL	PL	P-P	P-P
Level	1	2	3	4	5	6	7	8	9	10	11	11 (pits)
Corn cobs	*	*	453	198	231	104	387	457	629	618	598	409
Beans plus pods	..	3	1	..	..	..	1	2	4	7	4	1
Squash (pepo) stems	1	4	5	2	..	..	1	2	2	2	1	5
Squash remains present	×	×	×	×	..	..	×	×	×	×	×	×
Lagenaria fragments	..	6	3	2	..	4	8	5	5	7	7	3
Cucurbita foetidissima roots	..	1	2	..	2	6	6	5	..	..	..	..
Cucurbita foetidissima pulp	..	..	..	4	12	13	12	..	..	1	1	1
Cucurbita foetidissima shell	1/20	1/25	..	3	10	10	19	..	1/4	1/20	1/20	1
Yucca pods	..	..	1	1	..	1	1	1	..	2	..	..
Echinocereus fragments	1	1	1	6	17	9	3	1	2	4	1	..
Oenothera bases	2	1	1	5	3	..	1	3	1	..	..	..
Thistle remains	..	1	1	1	12	5	7	3	4	1	1	1
Wads, corn husk	..	6	3	..	2	2	8	9	12	12	4	1
Wads, agave and yucca	1	1	1	10	1	4	1	2	..	3	2	1
Wads, grass stems	..	1	..	..	1	3	3	2	1	2	2	1
Wads, woody stems	..	..	..	..	..	..	1	..	1	1	1	..

* Cobs uncounted

San Francisco. [Only 11 sherds were found in this level, 8 of which were Alma Plain.—P.S.M. and J.B.R.]

Wads of corn husk are found in nearly all levels of the cave. These objects have been described in the literature as quids but this is an unfortunate name, at least for the Tularosa Cave specimens, because it suggests chewing. The majority of the wads found in Tularosa Cave are *not* chewed but show obvious signs of having been manipulated by the fingers and in many cases are worn in a fashion which suggests they were used to clean some surface, presumably pots (Fig. 175). In other words, they are the forerunner of the modern housewife's metal pot-cleaners. They do not appear to be suitable for such varied uses as gourd stoppers, menstrual plugs, toilet paper, pot rests, pot holders, pads, or bandages, which have been suggested to me, nor do the materials and their present condition indicate they were chewed. This is not necessarily true of similar objects from other sites. From Cordova Cave, for example, there are wads which are chewed, but these are the fibers of *Martynia* pods and cacti and in that cave cultivated plant materials form a much smaller proportion of the remains than they do in Tularosa Cave.

The wads have been grouped into four classes, those of corn husks, those of the fibers of yucca and agave, those of the stems of large grasses and sedges, and those from woody stems. If the material from Cordova Cave was considered, a fifth class consisting of the fibrous remains of *Martynia* and cacti would have been added (Table 4). In Tularosa Cave the proportion of corn husk wads decreases during the Georgetown Phase.

Cucurbita pepo L., squash or pumpkin. All of the squash material is of this species, readily identified by the nearly straight sides of the fluted stem (Fig. 176). A few of the stems have a slight flare at the base and lack prominent prickles, suggesting some introgression with *C. moschata* but no significant distribution of this tendency has been discovered so far. The uniformity of the squash seeds and the occurrence of a large number with peculiar marking in a bison skin bag suggest that these all came from one fruit, a large one if the size of the seeds is a valid indication, and it is likely that some selection of better fruits for planting purposes was practiced.

Phaseolus vulgaris L., kidney bean. All of the beans are of this species and there is relatively little difference in size and shape

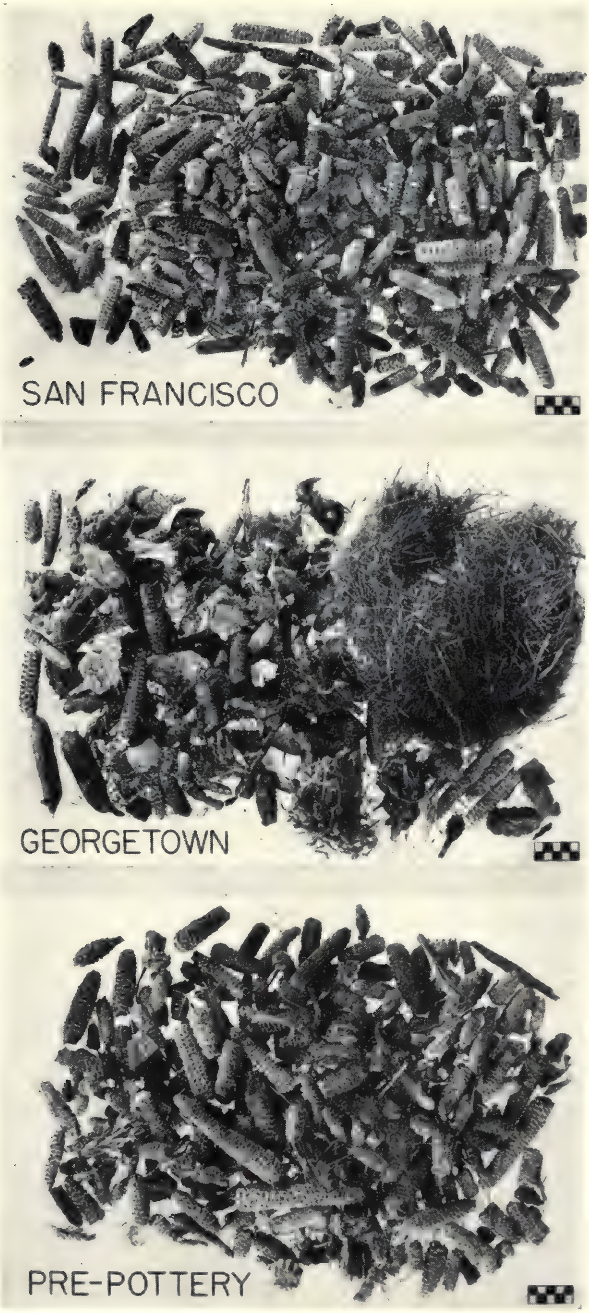

SAN FRANCISCO
GEORGETOWN
PRE-POTTERY

FIG. 174. Vegetal remains from Pre-Pottery, Georgetown, and San Francisco phases, showing the large amount of non-cultivated material in Georgetown. Scale in centimeters.

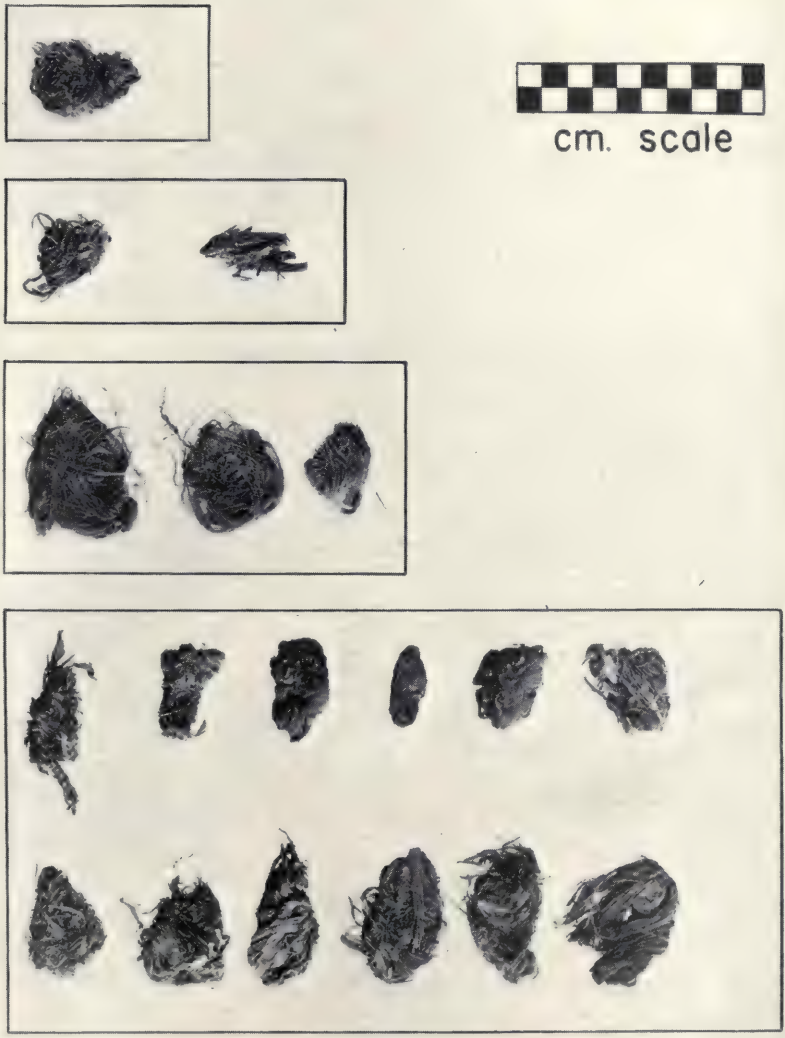


FIG. 175. Wads from Level 10 of Square 3R2 (Pine Lawn): twelve corn husk wads in bottom row, three yucca wads in second row, two grass stem wads in third row, and one wad of crushed woody stems in top row.

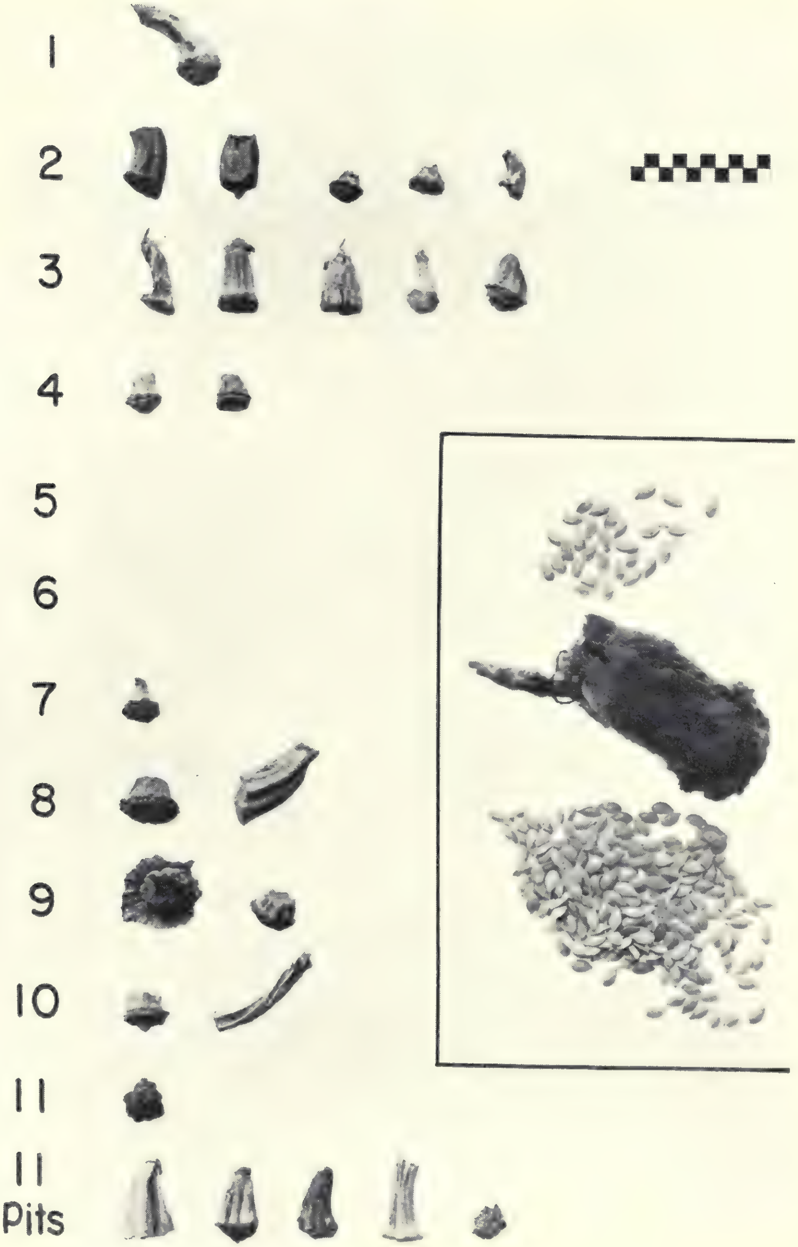

1
2
3
4
5
6
7
8
9
10
11
11
Pits

FIG. 176. Squash stems from Square 3R2 arranged by levels, and bison skin seed pouch with scarred seeds above, unscarred below. Scale in centimeters.

of the seeds. The beans are white, white with a purple or brown spot about the point of attachment, and purple. Several beans slightly discolored by age may have been brown and one appears to have been lightly speckled. The pods were relatively short.

Lagenaria siceraria Standl., white-flowered gourd, bottle gourd. This is found in all phases, from the earliest to the surface. Most of the gourds appear to be of the moderately large bottle type, 8 to 10 inches in diameter, although a few probably represent much smaller fruits. No seeds have been discovered so far and it is impossible to tell if more than one variety was present.

The gourd has been known in the New World for so long that it seems unlikely that this, the only important cultivated plant grown in both hemispheres before Columbus, was introduced by man. The rhizomes of cattail and canary reed grass were used by man in both hemispheres but as far as I know no one has suggested that these species, or other cosmopolitan wild plants used long ago in both the Old and New Worlds, were transplanted. Further indication of independent domestication is the extensive use of the young and still succulent gourds as a vegetable in Asia and parts of Africa but not in the New World.

Gossypium sp., cotton. The amounts of cotton fiber are not large in comparison to the cordage and textiles of the hard (agave and yucca) and bast (*Apocynum?*, *Asclepias?*) fibers, and no seeds or parts of the plant have been found so far.

Helianthus spp., sunflowers. The following report has been prepared by Dr. Charles B. Heiser, Jr., Curator of the Herbarium, Indiana University.

"The sunflower remains from Tularosa Cave are of considerable significance, for they are the first sunflower seed heads reported archaeologically from the Southwest. Of considerable interest also is the fact that three different species are represented.

"The first of these is *Helianthus annuus*, which is readily recognized by its large size and broad involucral bracts. Three main races of the common sunflower are now recognized: *H. annuus* var. *macrocarpus*, the giant monocephalic cultivated forms; *H. annuus* var. *annuus*, the ruderal sunflower of the middle western and eastern United States; and *H. annuus* var. *lenticularis*, the wild sunflower of the western United States (Heiser, 1951). All of the Tularosa Cave material of this species thus far examined clearly falls into the

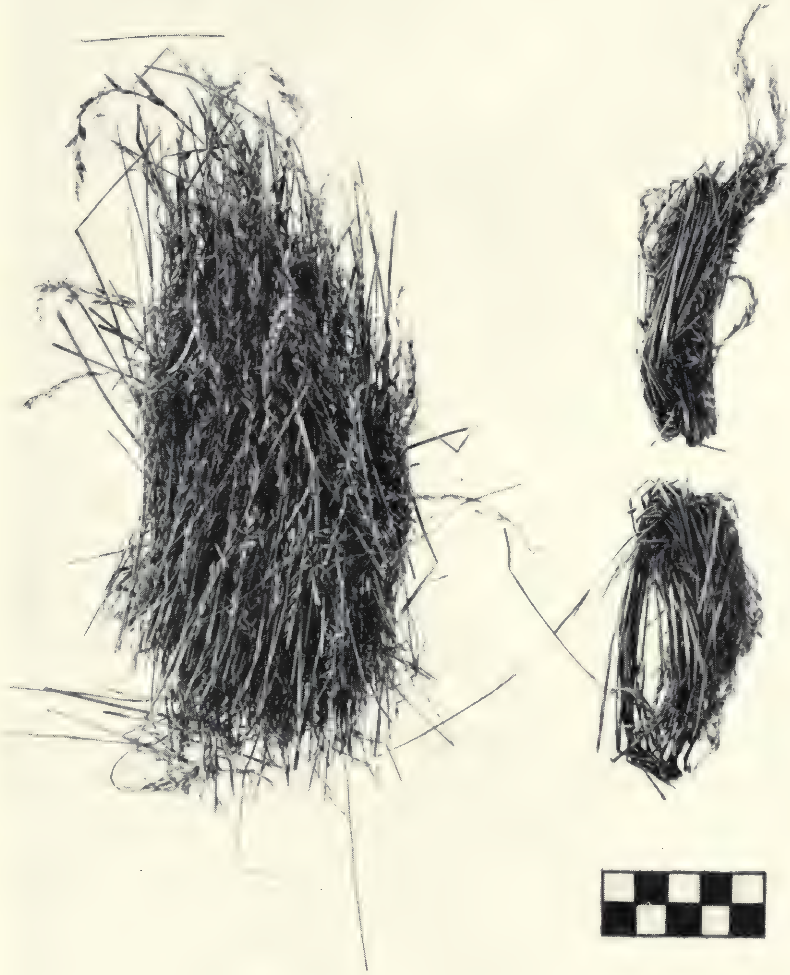


FIG. 177. Stalks of grass (*Poa fendleri*) found in neat piles (Square 2R1, Level 8) and tied in groups containing from 12 to 40 stalks (Square 2R1, Level 10). Scale in centimeters.

range of the last named variety. We do not know how the inhabitants of this region used these plants, but the presence of sunflower heads at almost every level suggests that they were gathered for some definite purpose. There are numerous accounts of the collection of the seeds of this sunflower by the Indians of the western United States in historical times for use as food. The plants were also used medicinally and ceremonially.

"The only previous report of the sunflower in the West for prehistoric times is based on a single achene found at the Castle Park, Colorado, site and tentatively identified by Jones (1948) as belonging to wild *H. annuus.* Prehistoric painted wooden sunflower disks which apparently were ceremonial objects have been found in northeastern Arizona (Kidder and Guernsey, 1919), and the sunflower was also used as a design on prehistoric Hopi pottery (Fewkes, 1919, Fig. 79).

"The heads of the two other species of sunflower occurring in these deposits are much less frequent than *H. annuus.* The first of these is probably *H. praetermissus* or possibly *H. petiolaris.* Both of these species are annual and closely related to *H. annuus.* Today *H. praetermissus* is known only from two localities—the type locality in eastern Valencia County, New Mexico, which is only a short distance from Tularosa Cave, and a second locality near Fort Stockton, Texas. *Helianthus petiolaris,* on the other hand, is rather widespread in the western United States. Both species have heads and achenes much smaller than those of *H. annuus.* Achenes of *H. petiolaris* are known to have been gathered for food by certain Indians.

"The identity of the other sunflower heads is still more doubtful. They appear to match rather closely the heads of some of the perennial sunflowers, particularly *H. grosseserratus* and *H. Nuttallii. Helianthus grosseserratus* at present reaches its southwestern limits in eastern New Mexico. The second species, however, is rather widespread in the western United States. The use to which these sunflowers was put is unknown. Certain members of this group of sunflowers produce fleshy roots which are known to have been used by various Indians for food."

Wild Plants

The number of wild plant species found in Tularosa Cave is larger than that of the cultivated plants but the volume of material, with the exception of a few levels, most of them in the Georgetown Phase, is much less. The material from each level of the cave was cleaned by passing over a one-quarter inch screen. While this would allow very small seeds to fall through with the refuse, an examination of the screenings showed that relatively few seeds were present. Most of the screenings consisted of dirt and broken pieces of corn cob, grass, food fragments, and pinyon nut shells. Pinyon nut shells were discarded for they were present in large numbers and found in all levels of the cave. A few beans may have been lost at this time but none could be discovered in a later examination of the screenings. Only the more obvious of the wild plant remains were identified in this preliminary survey. The plants are arranged in the same order as they are found in Kearney and Peebles' *Flora of Arizona* and with only a few exceptions the names they list have been followed.

Equisetum sp.; horsetail.

Pinus edulis Engelman; pinyon.

Pinus ponderosa Douglas ex P. Lawson; ponderosa pine, western yellow pine.

Juniperus pachyphloea Torrey; alligator juniper.

Juniperus monosperma (Engelman) Sargent; one-seed juniper.

Juniperus utahensis (Engelman) Lemmon; Utah juniper.

Poa fendleriana (Steudel) Vasey; mutton grass. Apparently this species was gathered for seed, since large amounts of the chaff, numerous knotted bundles containing from 12 to 24 stems, and several piles of ripe stalks with the grains gone (Fig. 177) were found. Identified by Dr. George B. Van Schaack, Missouri Botanical Garden.

?Eragrostis diffusa Buckley; lovegrass. Identified by Dr. J. P. Swallen, United States National Herbarium.

Phragmites communis Trinius; reedgrass, carrizo. Used for arrow shafts, cigarettes, and matting. Besides the manufactured objects and numerous pieces of burned and broken shafts, several inflorescences were found. Identified by Dr. Van Schaack.

Koeleria cristata (L.) Persoon; junegrass. Identified by Dr. Van Schaack.

Sporobolus contractus Hitchcock; dropseed grass. Identified by Dr. Van Schaack.

Bouteloua gracilis (HBK.) Lagasca ex Steudel; blue grama. Identified by Dr. Van Schaack.

Sorghastrum nutans (L.) Nash; Indian-grass.

Scirpus validus Vahl; bulrush.

Yucca baccata Torrey; yucca, Spanish bayonet, datil. This is the species most widely used as a source of the leaf strips and fibers found in sandals and cordage. The pods are especially common in the Georgetown Phase, although they are frequently found in other phases as well.

?Yucca elata Engelman; amole, narrow-leaved yucca.

Nolina microcarpa S. Watson; beargrass.

Dasylirion wheeleri S. Watson; sotol.

Salix sp.; willow.

Populus sp.; poplar, cottonwood.

Juglans major (Torrey) Heller; walnut.

Quercus spp.; oaks.

Chenopodium sp.; pigweed, goosefoot.

Cycloloma atriplicifolium (Sprengel) Coulter.

Amaranthus sp.

Berberis repens Lindley; Oregon grape, holly grape.

Descruinia pinnata (Walter) Britton; tansy mustard.

Cowania stansburiana Torrey; cliffrose.

Cercocarpus sp.; mountain mahogany.

Mentzelia albicaulis Douglas ex Hooker; stick-leaf, blazing star.

Echinocereus triglochidiatus var. *melanacanthus* (Engelman) L. Benson; hedgehog cactus. This is the same as *E. coccineus* Engelman.

Opuntia sp.; prickly pear cactus.

Oenothera deltoides Torrey and Fremont; desert primrose.

Ligusticum porteri Coulter and Rose; cough-root.

Lithospermum incisum Lehmann; gromwell.

Nicotiana attenuata Torrey ex Watson; wild tobacco.

Cucurbita foetidissima HBK., calabazilla, wild gourd. The large storage roots of this plant contain considerable starch and are edible when properly prepared, although the taste is never very attractive. Many of the masses of pulp from the almost ripe fruit were found in some levels and the rubbed appearance of some of these suggests that they may have been used as scouring pads. This rubbed appearance may also have been caused by trampling the pulp after the seeds had been removed for eating.

Helianthus spp.; sunflowers. There are several wild sunflowers in the material, but they have been discussed under cultivated material.

Cirsium sp.; thistle. Thistle leaves were found in many levels, and in a few, especially in the Georgetown Phase, there were small piles of as many as 40 in one level of a square. Cirsium is mentioned in several sources as a medicine among the Hopi.

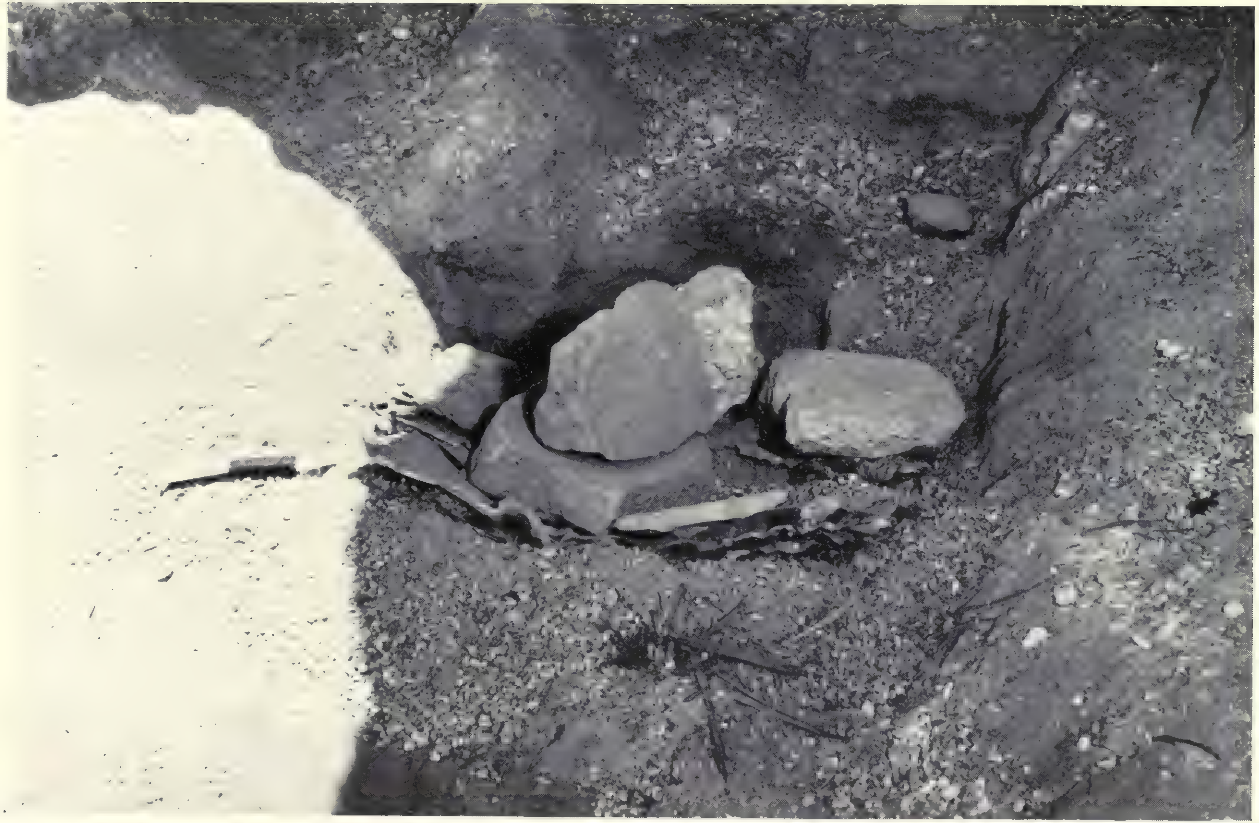


FIG. 178. Apache cache; metate and slab lying on folded horse hides.

XI. A Cache of Apache(?) Material, Cordova Cave

By PAUL S. MARTIN

Near the mouth of Cordova Cave, in Square 2R1, Levels 1 to 5, was an intrusive pit containing the following:

Two pecked metates, a slab on which paint had been ground, and an upright slab.

Five hides, folded, lying under slabs (Fig. 178).

Some loose corn husks and a bundle of corn husks tied together, all of which were between the second and third hides (Fig. 179).

Several small hides resting on a nest of pine needles, and in the nest a bit of finely woven cloth and an entire bear grass plant.

Fragments of twilled-twined, pitch-coated basket (Fig. 120, bottom), machine-made cotton cloth, strands of European yarn, and portions of a leather knife-sheath.

Examination of the hides by Mr. Colin C. Sanborn, Curator of Mammals, showed that four of the hides were horse and the other one possibly bear. Hair was still present; paint had been spilled on one hide. The hides may have been used as robes.

Since the hides were those of horses, we assumed that the cache was probably the work of Apache Indians who lived in the Reserve area during the last few centuries.

The metates looked like prehistoric types and may well have been, because the Apaches often picked up and used old metates left by the "ancient people," although they sometimes made their own (Opler, 1941, pp. 384, 385).

The meaning of the corn husks is not certain. It is possible that they were put aside for use as cigarette papers or as wrappings for tamales (Opler, 1941, pp. 374, 442). It is probable that agriculture was practiced only occasionally and that it never exerted much or any influence on rituals, beliefs, or myths (Castetter and Opler, 1936, p. 29). Therefore, these corn husks probably do not represent a ceremonial bundle of any kind.

We have no way of determining the age of this cache, but we think it is fairly recent (since 1880).

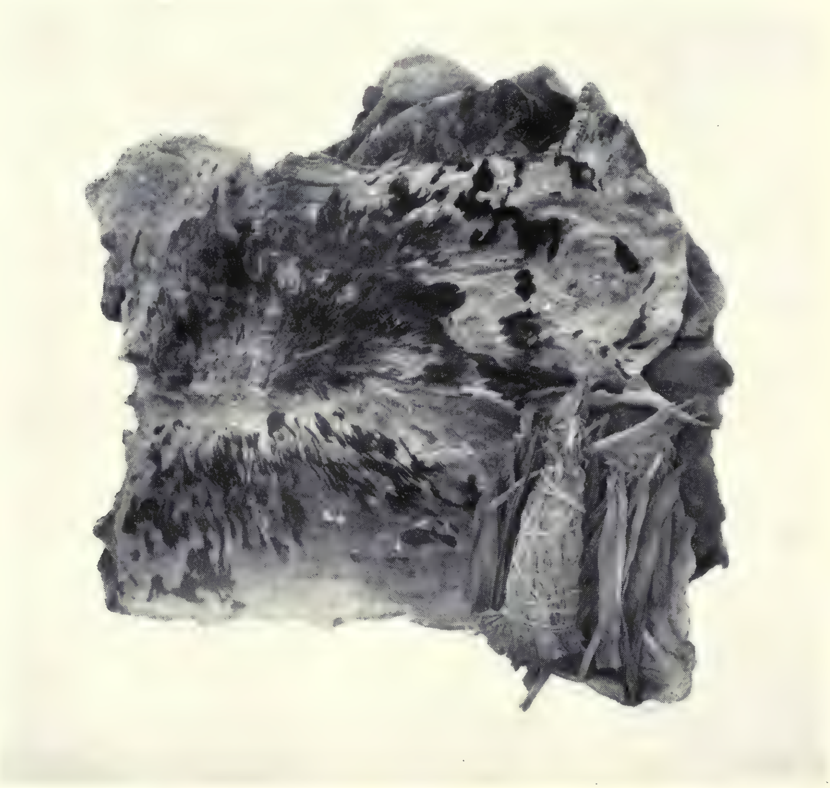


FIG. 179. Apache cache; horse hides and bundle of corn husks.

XII. Summary and Conclusions

By PAUL S. MARTIN

Summary

This report covers the excavation of and analysis of materials from two caves—Tularosa Cave, dug in 1950, and Cordova Cave, dug in 1951.

Tularosa Cave appears to have been occupied more or less continuously from about 300 B.C. to A.D. 1100.

Cordova Cave may have been occupied as early as 300 B.C., but probably only sporadically after the beginning of the Christian era.

The materials recovered from these two caves were extensive and represent one of the best-documented collections of perishable specimens of the Mogollon culture. The stratified deposits in Tularosa Cave verified the typological sequences that we had established from excavations in near-by open sites. The sequence, then, from Tularosa Cave, is one of the longest sequences for the Mogollon culture.

Since we now have a few Carbon 14 dates for the Reserve area, we herewith give them and correlate them with the already established phases.

2556 B.C. ±680 years	Chiricahua stage of Cochise, found in Wet Leggett Canyon, Pine Lawn Valley, New Mexico (Johnson, 1951, p. 16)
ca. 300 B.C. ±200 years to ca. 150 B.C.	Pre-Pottery Phase, Tularosa Cave (Johnson, 1951, pp. 17, 18)
ca. 150 B.C. ±160 years to ca. A.D. 500	Pine Lawn Phase (earlier date from Carbon 14, Tularosa Cave, Johnson, 1951, p. 17; later date inferential)
A.D. 500–700	Georgetown Phase (estimated dates)
A.D. 700–900	San Francisco Phase (tree-ring dates; Smiley, 1951)
A.D. 900–1000	Three Circle Phase (estimated dates)
A.D. 1000–?	Reserve Phase (estimated dates)

Trait List of the Mogollon Culture, Reserve Area, New Mexico

In an attempt to pull together all of the elements embodied in this report, we have listed all of the traits of the tangible culture from Tularosa and Cordova caves as well as from open sites. These traits have been placed under suitable subject headings by phases.

The symbols in parentheses refer to the detailed description of this class of artifacts. By looking under the proper chapter and heading, one can secure the available data; for example, if the reader wishes to find the available data for "Weapons, Projectile points, Corner notched, expanding stem, thinned base(a)," he may turn to the chapter on "Specimens of Stone, Bone, and Clay," which contains a section on Projectile Points and Blades, and under (a) he will find the pertinent data.

After many of the traits, we have inserted comments having to do with trends; for example, we may list a sandal type and parenthetically remark "decreasing in frequency." This may be taken to mean that this particular sandal type is less popular than in the preceding phase and is presumably a type that will be replaced by another.

If no parenthetical remark follows a trait, one may infer that there is no significant change in trend or that the lack of a remark means that the trait is "present" and there is nothing more to be said about it. An asterisk indicates that the trait may be characteristic of the Reserve Phase, but that it occurs in the San Francisco-through-Reserve levels.

Conclusions

Having excavated two caves and having analyzed the materials recovered from them, we are faced with the problems of sifting these data and of presenting trends, generalizations, and principles of culture growth and change, if any may be discovered. What problems were solved and what remain?

Let us turn first to significant or major trends that have been noted.

From our previous work, we sensed that a change, perhaps a major one, took place about A.D. 700, or the beginning of the San Francisco Phase (Martin and Rinaldo, 1943, p. 125; Martin, Rinaldo, and Antevs, 1949, p. 19). In the detailed analyses of the cave materials by Rinaldo, Bluhm, and Grange this change has been

TRAIT LIST OF MOGOLLON CULTURE, RESERVE AREA, NEW MEXICO

Body and Dress

	Pre-Pottery	Pine Lawn	Georgetown	San Francisco	Reserve
Footgear					
Sandals					
Wickerwork (I, A–D)	predominate	predominate	predominate	important	present*
Plaited (II, A–F)			introduced	present	predominate*
Multiple-warp (III, A–D)			present	decrease	decrease*
Continuous-outer-warp (IV, A–B)		present		present	
Concentric-warp (V, A–B)	present	present	present	present	present
Scuffer-toe (VI, A–C)				present	present*
Leather, plain			present		
Leather, winter	present	present		present	
Moccasins	present				
Ornaments					
Bracelets, shell	present	present			present
Beads	bone tube	bone tube, whole olivella, cut shell	whole shell, reed	bone tube, whole shell	bone tube, shell
Pendants	bark, wood, gourd	bone, stone	shell, deer tooth, stone		
Miscellaneous ornaments				feather, fig beetle femora, twig ring	
Clothing					
String apron			present		present*
Sash, twisted cord		present			
Blankets		fur cord, feather cord	fur cord, fur and feather cord	fur cord	

TRAIT LIST OF MOGOLLON CULTURE, RESERVE AREA, NEW MEXICO—*continued*

Subsistence

	Pre-Pottery	Pine Lawn	Georgetown	San Francisco	Reserve
Metates					
Basin	predominate	present	present	decrease	....
Slab	present	present	present	....	present
Trough closed at one end	....	present	present	increase	present
Trough open at both ends	....	....	....	....	present
Manos					
Ovoid-round, 1-hand	predominate	predominate	present	present	....
Rectangular	....	present	....	increase	increase
Beveled	....	....	....	....	characteristic
Small, metate-like grinding stones	present	present	present	present	present
Mortars					
Pebble	....	present	decrease	decrease	present
Boulder	....	present	present	decrease	....
Pestle	....	present	....	present	present
Snares					
Rope	present	....	....	....	....
Forked stick	....	present	....	....	....
Hinged stick	....	....	....	....	present
Trigger(?)	....	....	present	....	....
Digging stick	present	present	present	present	present
Food	maize, beans, squash, gourd, yucca pods, cacti, black walnuts, acorns, grass seeds, desert primrose leaves, sunflower seeds	same as Pre-Pottery	same as previous phases; greater frequency of gathered wild plants over cultivated plants	same as previous phases, corn type changes	same as previous phases

TRAIT LIST OF MOGOLLON CULTURE, RESERVE AREA, NEW MEXICO—*continued*

	Pre-Pottery	Pine Lawn	Georgetown	San Francisco	Reserve
		Houses and Furnishings			
Pit-houses	....	present	present	present	....
Multi-roomed, single story, contiguous rooms, masonry walls	....	....	....	....	present
Grass beds	present	present	present	present	....
Fur and/or feather blankets	....	present	present	present	....
Storage pits in floors of houses or in caves	present	present	present	rare	....
Bins	....	....	....	....	present
Wads of plant fibers for scouring pots or metates	present	increase	slight decrease	more decrease	....
		Transportation			
Cradles					
Flexible	present	present	present	....	....
Rigid	....	....	....	....	present
Netted carrying bags	present	present	present	present	present
Twined flexible carrying basket	....	present	....	....	....
Toggles for tump lines	....	present	present	present	....
Burden strap	....	....	present	....	....
		Fire			
Torches	bear grass root	....	....	....	pine needle
Fire drill hearths	present	present	present	present	present
Fire drills					
Simple	....	....	present	present	present
Compound	....	....	....	present	....
Tongs	....	....	....	present	....

TRAIT LIST OF MOGOLLON CULTURE, RESERVE AREA, NEW MEXICO—*continued*

Weapons

Projectile points	Pre-Pottery	Pine Lawn	Georgetown	San Francisco	Reserve
Corner notched, expanding stem, thinned base(a)	present	decrease	....	....	....
Small, shallow lateral notched(d)	present	decrease	....	present	....
Slender, lateral notched, expanding base(e-1)	present	present	present	....	....
Diagonal notch, down-raking barbs, expanding convex base(b)	present	slender variant increasing	present	present	small variant more common
Lateral notch, ear-like barbs, concave base(p)	....	....	....	....	present
Spear points					
Large, lateral notch	present	present	....	....	present
Atlatls and darts	present	present	present	decrease	....
Atlatl dart bunts	present	present	present	decrease	....
Atlatl charm stones	....	....	present	decrease	....
Bows (hunting) and arrows	present	present	present	increase	increase

TRAIT LIST OF MOGOLLON CULTURE, RESERVE AREA, NEW MEXICO—*continued*

Tools

	Pre-Pottery	Pine Lawn	Georgetown	San Francisco	Reserve
Blades					
Narrow, straight-edged(m-4)	present	decrease	...	...	...
Ovoid, convex base(m-5)	predominate	predominate	predominate	...	...
Point off-center(o)	present	decrease	...	...	...
Leaf-shape, basal edges straight(l)	present	increase	decrease	...	...
Knives					
Random flake(a)	present	present	present	decrease	present
Blade-like(b)	present	present	decrease	decrease	decrease
Scrapers					
Random flake, side(a)	predominate	common	present	present	decrease
Serrate, nodular, side(e)	present	present	decrease	decrease	present
End	present	decrease	present	present	present
Thin flake side scraper	present	present	increase	present	present
Hollow edge	present	present	present	present	present
Discoidals	present	...	...	...	present
Choppers					
Uniface(a-1)	predominate	increase	present	present	increase
Biface	...	...	increase	increase	increase
Hammerstones	present	present	present	present	present
Rubbing stones	present	increase	increase	present	increase
Polishing stones	...	present	present	decrease	present
Abrading stones	present	present	present	present	present
Awl sharpeners	...	present	present	?	present
Drills					
Plain shafted(b)	present	present	present	...	decrease
Small, abruptly widened flange(c-1)	present	decrease	decrease	decrease	decrease
Wing base(c-3)	rare	...	...	...	...
Broad base(c-2)	present	increase	?	decrease	...
Sharpened flake(a-1)	present	present	increase	...	...
Gravers	present	present	...	present	increase
Hoes	...	...	...	present	increase

TRAIT LIST OF MOGOLLON CULTURE, RESERVE AREA, NEW MEXICO—*continued*

Tools—*continued*

	Pre-Pottery	Pine Lawn	Georgetown	San Francisco	Reserve
Saws	...	...	...	present	present
Awls, bone					
Stubby	present	present	...	...	...
Plain	...	increase	increase	present	present
Notched	...	increase	...	present	present
Notched ribs	present	present	...	...	...
Bone fleshers	present	present	present	...	present
Bone punches or knives	...	...	present	present	...
Bone flakers	...	...	present	...	present
Antler rubbers or hammers	present	...	...	decrease	...
Antler flakers	...	present	...	...	present
Antler wrench	...	present	...	...	...
Wooden knife handles	present	...	...	...	present*
Wooden scoop	present	...	present	...	...
Trowels, wood and bark	present	present	...	decrease	...
Burred sticks, feather carding	present	present	present	present	...
Wooden awls	...	present	...	...	present*
Lap boards	...	present	...	present	present*
Wooden ladle	...	...	...	...	present*
Pot rests	...	present	present	present	present
Brushes	...	present	...	present	present
Spindles	...	...	present	...	present
Spindle whorls	...	...	present	present	...
Corn cob pottery smoother	...	present	...	...	...
Weaving tool, wood	...	...	present	...	...
Spatula, wood	...	...	present	...	...
Stick, charred, shouldered, pointed	...	...	present	...	present*
Wooden spoon	...	...	...	present	...
Needles, yucca spine	...	...	...	...	present
Yucca-leaf glue-brush	...	...	...	...	present*

TRAIT LIST OF MOGOLLON CULTURE, RESERVE AREA, NEW MEXICO—*continued*

Textiles

Basketry	Pre-Pottery	Pine Lawn	Georgetown	San Francisco	Reserve
Coiled					
2-rod-and-bundle	predominate	predominate	predominate	predominate	...
Bundle-with-rod-core	present	present	...	present	...
Bundle	...	...	present	present	...
Half-rod-and-bundle	...	...	...	present	present*
Twilled ring	...	...	...	...	present
Tied-twined	present	...	...	...	...
Twined					
Flexible	...	present	...	...	...
Rigid	...	...	...	...	present*
Matting					
Twilled	...	...	present	present	present
Twined and sewed	...	present	present	...	...
Cloth					
Cotton, over-one-under-one weave	...	...	...	present	predominate
Cotton, tapestry technique, 3-color design	...	...	...	...	present*
Bast fiber, over-one-under-one weave	...	...	...	present	present
Netting					
Knotless	...	...	present	...	present*
Coiled, on warps	...	...	...	present	present*
Tied with square knots	...	...	present	...	...
Tied with overhand knots	...	present	...	...	...
Twined fabric					
Bast fiber	...	...	...	present	present
Bast, hard, and hair fiber	...	...	...	present	...
Fur and/or feather cloth (see blankets)	...	present	present	present	...

TRAIT LIST OF MOGOLLON CULTURE, RESERVE AREA, NEW MEXICO—*continued*

Receptacles

	Pre-Pottery	Pine Lawn	Georgetown	San Francisco	Reserve
Gourd vessels	present				
Tubular wooden container	present				
Bags of leather	present		present		
Quiver				present	
Baskets	present	present	present	present	present
Yucca-leaf container for pitch			present		
Unfired pottery	rare	present	present	increase	present*
Pottery					
Alma Plain		present	increase	decrease	decrease
Alma Rough		present	decrease	rare	
San Francisco Red		present	present	present	decrease
Mogollon Red-on-Brown				present	
Alma Neck Banded			present	increase	
Alma Scored			present	increase	
San Lorenzo Red-on-Brown			?	present	
Three Circle Red-on-White				present	
Three Circle Neck Corrugated				present	
Alma Incised				present	
Reserve Smudged				present	present
Reserve Black-on-White					present
Smudged Decorated					present
Plain Corrugated					present
Reserve Indented Corrugated					present
Reserve Fillet Rim					present
Incised Corrugated					present

TRAIT LIST OF MOGOLLON CULTURE, RESERVE AREA, NEW MEXICO—*continued*

	Pre-Pottery	Pine Lawn	Georgetown	San Francisco	Reserve
Musical Instruments					
Flutes, reed	present	present	present	....	....
Play					
Dice					
Wooden	present	present	present	decrease	....
Bone	present	present	....	present	present
Stone balls	present	decrease	present	present	present
Darts(?), corn cob mounted on feather	....	....	....	....	present*
Trade					
	....	shell bracelets, Gulf of California	....	pottery from Anasazi: La Plata B/W White Mound B/W Kiatuthlanna B/W	pottery from Puerco and Mimbres: Puerco B/W Mimbres B/W
Cycle of Life					
	....	burial of dead in rubbish of cave or sub-floor pits in pit-houses	....	....	....

TRAIT LIST OF MOGOLLON CULTURE, RESERVE AREA, NEW MEXICO—*continued*

Ritual

	Pre-Pottery	Pine Lawn	Georgetown	San Francisco	Reserve
Paint grinding stone	rare	present	....	present	present*
Pigments	present	present	present	present	present
Crystals	present	present	present	....	....
Miniature ladles		present	....	present	....
Pipes, stone and pottery		present	present	decrease	decrease
Reed cigarettes		rare	present	increase	increase
Figurines					
Human		present	present	present	....
Animal effigy		....	present	present	present
Phallic image		....	present	....	present
Cornucopia		....	....	present	....
Juniper-berry skewers	present	present	present	decrease	present*
Tablitas		....	rare	present	present
Miniature bows and arrows		....	....	introduced	present
Ceremonial bows		....	....	introduced	....
Medicine man's bag		....	....	present	....
Pahos(?)					
Corn cob on stick		introduced	....	present	present
Feather on stick	present	....	present	present	....
Deer hoof charm		present	present	present	....
Reed stalk on reed stem		introduced	present	present	....
Crook		....	....	....	present*
Stick with seeds impaled		....	....	....	present*
Carved		....	....	....	present*
Painted stick		....	rare	present	increase
Stick with incised pattern on bark	present	present	present	present	....
Large pit-house (kiva)		present	....	present	....

TRAIT LIST OF MOGOLLON CULTURE, RESERVE AREA, NEW MEXICO—*concluded*

Miscellaneous Objects

	Pre-Pottery	Pine Lawn	Georgetown	San Francisco	Reserve
Sticks with binding, fiber, sinew or hair	present	present	present	decrease	...
Wood with fiber tied around it	...	present	...	...	...
Stick with knotted yucca binding	...	...	...	introduced	present
Sticks bound together	...	...	...	...	present*
Bundle of sticks	...	present	...	...	...
Split sticks	present	...	present	present	present
Curved stick	present	...	...	...	...
Pithy twig with encircling incision near one end	...	...	...	...	present
Split stick spatula	...	...	...	...	present*
Tooth-marked stick	...	...	...	present	...
Wooden cylinders	present	present	...	decrease	present
Reed tube	...	present	present	present	present*
Fiber-capped reed	present	...	...	...	...
Twigs tied in loops	present	present	present	...	present*
Hoop-like object	present	present	present	...	...
Netted hoop	...	present	...	present	...
Worked gourd rind	...	present	present	present	...
Stick, charred, shouldered, pointed	...	...	rare	present	present*

observed again. The maize also changed at this time, as pointed out by Cutler in his chapter on "Plant Remains."

But two other changes have also been observed. One took place at the beginning of the Pine Lawn Phase—at which time pottery, houses, reed cigarettes(?) and other traits appeared. The other major shift took place at the beginning of the Reserve Phase (Martin and Rinaldo, 1950b, pp. 552–555).

Thus, three shifts or cycles or changes have occurred: (1) The first at about 150 B.C., the approximate beginning of the Pine Lawn Phase; (2) the second at about A.D. 700, the start of the San Francisco Phase; (3) and the third at about A.D. 1000, the inauguration of the Reserve Phase.

These shifts may be thought of as indications of the culture process; in them are factors that operated toward growth and change. The changes included increments or learned traits, probably acquired from other sources and, in some instances, losses or displacements. Between these shifts, the various parts of the culture were preserved with little change and thus these periods may be thought of as stable.

What caused these shifts? We do not yet know. Certainly external change—diffusion; internal factors, such as alterations on the subsistence level; mild or localized climatic changes; increase in population—any or all of these may have been responsible. One factor—diffusion—we can put our finger on and feel fairly certain that we have singled out an apparent and perhaps important (although not the only) cause for some of these changes. The introduction of pottery and architecture at the start of Pine Lawn times may be an example of this diffusion.

On the whole, we have tended to think of the Mogollon culture as a more or less isolated, self-contained complex; but that it was breached, and several times, becomes more apparent as our knowledge of the culture increases.

These changes will some day be correlated with others that may have been occurring in the Southwestern Co-Tradition and will probably cause some minor changes in that conceptual scheme (Martin and Rinaldo, 1951).

Some of the trends that should be noted here are:

1. Basin metates are early and through trough metates, late.

2. Slab metates continue in use from early to late; trough (open at one end only) from Pine Lawn to Reserve.

3. Projectile points with concave base and narrow shoulder (Pinto-like) as well as small points with shallow lateral notches, straight base, and serrate edges are early. In late times two other types appeared: the lateral notched type, with ear-like barbs and concave bases; and a second, a small triangular point with lateral notches and serrate edges.

4. Wickerwork sandals are early (Pre-Pottery), whereas plaited sandals are late.

5. The multiple-warp sandals that resemble those from the Basketmaker III period are most common in the Georgetown Phase of Tularosa Cave.

6. Cotton cloth makes its initial appearance at the beginning of the San Francisco Phase (ca. A.D. 700).

7. Coiled basketry was the important type from the Pre-Pottery Phase up to the San Francisco Phase. It was displaced as a major type by twilled basketry, which continued in favor through the Reserve Phase.

8. At or about the advent of the San Francisco Phase, we find that hunting bows (and arrows) and ceremonial and miniature bows and arrows appeared. The atlatl was gradually displaced by the bow.

9. It is interesting to observe that the popularity of Juniper-berry skewers (that we guess had ceremonial usage) declines as soon as the miniature bows and arrows put in their appearance. Did the toy bows take the place of Juniper-berry skewers in rituals?

10. The frequency of reed cigarettes also increases in San Francisco times. Perhaps they, too, were associated with new rituals or with an increased emphasis on them.

11. Tubular tobacco pipes may have been more popular than cigarettes in pre-San Francisco times; their frequency declines in post-San Francisco times. This statement, based mainly on the evidence from open sites that we have excavated, indicates that reed cigarettes gradually displaced pipes.

12. Tablitas (painted boards that were possibly worn as part of a ceremonial headdress) may have been present before San Francisco times, but certainly they increased in popularity during and after A.D. 700.

In general, the items assigned by us to ritualistic usage increase in variety and types during and after the San Francisco Phase. Such rich efflorescence of Mogollon ceremonial life may have been due to influences from the Anasazi culture, which is noted for its elaborate symbolic rituals, the emphasis on which probably goes back to the Basketmaker III period (great kivas). Ritualism may have been equally as important in the Mogollon culture in pre-San Francisco times, but we have no direct evidence on this point other than the "super" pit-houses or kivas noted by Haury and Sayles (1947, p. 42) and Martin and Rinaldo (1947, p. 292). These, if they be ceremonial structures or kivas, are earlier by several centuries than the kivas of the Anasazi. Although the Anasazi may be credited with altars, sand paintings, masks, ancestor impersonation, priestly offices, elaborate ritual, and much visual and verbal symbolism, we may eventually find that the bases or the inspiration for all of these may have reached the Anasazi through the Mogollon or Hohokam cultures. The southern sub-cultures (Mogollon and Hohokam) may have had many important rituals, although the physical apparatus for use in ceremonies is either simple in character or has not yet been recovered. Figurines occur in the earliest Hohokam phase (Vahki) and if these were utilized in any rituals, and if we assume that the "super" pit-houses (referred to above) were kivas, then we seem to have cults existing earlier in the south than among the Anasazi. This is not too surprising if the Southwestern Indians derived traits from Meso-America. Perhaps symbolic rituals and ceremonies were passed to the Anasazi through the Mogollon or Hohokam peoples and perhaps the Anasazi elaborated on them.

Trends of great interest have also been observed in the plant remains recovered from Tularosa Cave. Dr. Hugh C. Cutler, Curator of Economic Botany, has been studying this collection for many months and has not yet finished his analyses. This is not surprising in view of the fact that from a standpoint of quantity, preservation, and diversity this is the best and one of the largest archaeological collections of wild and cultivated plants that has ever been made. There are over 30,000 corn cobs and cob fragments alone! And these were found in all levels—from the Pre-Pottery Phase (about 300 B.C.) to the Reserve Phase (about A.D. 1000 plus). Dr. Cutler expects to publish the details of the results of his labors in the Botanical Series of this Museum. He has incorporated a brief chapter on some aspects of the plant remains in this monograph (Chapter X).

A few of the major trends noted by Dr. Cutler are these:

1. In the Georgetown Phase the proportion of gathered *wild* plants increased greatly in frequency over cultivated plants. The

amount of corn is nearly one-half of that found in the Pre-Pottery and Pine Lawn phases. The important wild plants gathered during the Georgetown Phase are thistles, yucca, cacti, grass, and wild gourds.

The explanation for this trend is not known. Several guesses, such as drought, a smaller population, a cultural shift in subsistence patterns, have been suggested, but none of these is completely satisfactory.

2. The number of rows per corn cob decreases from a mode of twelve per cob in the Pre-Pottery Phase to a mode of eight per cob in the San Francisco Phase. The change was most sudden between the Georgetown and San Francisco phases.

The decrease in number of rows per cob (noted above) might be explained by the fact that corn may have come from a better environment to a more rigorous one (near Tularosa Cave) and because natural selection there tended to cut down the number of rows. This shift in row numbers might equally well be due to the introduction (into the Tularosa Cave region) of a race of corn with low row numbers.

3. Tobacco was used in reed cigarettes (about A.D. 500), the earliest reported example in the Southwest.

Certain trends can likewise be noted in a study of the animal bones that were recovered from the caves. Mr. D. Dwight Davis and Mrs. Dorothy B. Foss identified all the animal bones from all levels of four squares in Tularosa Cave: Squares 4L1, 6R1, 2R2, and 3R2. After they had completed this study, Rinaldo took the results and charted them (Fig. 73). From this analysis, several interesting facts appeared:

1. Where the number of animal bones was of sufficient quantity (50 pieces or more) we found that the frequency of animal bones is greater in the Georgetown and pre-Georgetown phases than in later phases. Apparently more hunting was carried on in early times.

2. Deer was the favorite animal of the chase from early times through to late.

3. The bison occurs only in the San Francisco or later phases. x due

4. Very few bears were hunted (although we know they actually inhabited the cave at times!) and no mountain lions. Were these animals too large or fierce for the Indians to hunt? to x clima ?

5. Turkeys appeared in the Pine Lawn Phase, several centuries earlier than they have been reported in the Anasazi culture (late Basketmaker times; Amsden, 1949, p. 131). turkey

6. Muskrats occurred only in the early levels. Does this indicate a difference in climate?

7. Certain animal bones are entirely lacking, especially those of mountain lions, peccaries, cacomistles, beavers, reptiles, fish, and turtles.

To sum up briefly two important results of our excavations in the caves, we may say (1) that the stratigraphy found in them verified the chronological order and cultural sequences that we had previously constructed on the basis of typology alone from the artifacts of some half dozen, scattered, open sites; and (2) that the materials from the Pre-Pottery Phase have swelled the volume of specimens in each category and have given us a few new types of stone tools.

In addition to these trends that were observed for the data from the cave, we may make a few comparisons between some of the stone and bone tools from the cave and from Wet Leggett Canyon. It may be remembered that we found and reported on some forty tools of stone from Wet Leggett (Martin, Rinaldo, and Antevs, 1949, pp. 58–79); subsequently, thirty more were found. These have been classified as typologically the same as artifacts from the Chiricahua stage of the Cochise culture (Sayles and Antevs, 1941).

Since many of the tools from Tularosa and Cordova caves proceed from the Pre-Pottery Phase, we wondered if they were typologically the same as those found in Wet Leggett Canyon and whether the frequencies of types would be the same or similar. In other words, was the earliest deposit in the caves as old as that in the Wet Leggett?

Let us answer that question first. The oldest cave artifacts are probably not so old as those from Wet Leggett. We base this statement on two facts: (1) The difference in the Carbon 14 dates (about 2550 B.C. for Wet Leggett and about 350 B.C. for the Tularosa Cave materials); and (2) the analysis and seriation of the stone tool types.

This latter statement needs amplification.

Rinaldo can see that a typological continuity exists between the stone tools from Wet Leggett and those from the deepest levels in the caves; but the trend in artifact frequencies is discontinuous, and because the transitions in artifact popularities are not smooth, he feels that there is a break in time between the artifacts from Wet Leggett Canyon and those from the earliest levels in the caves. (For every scraper in Wet Leggett there are twenty in the deepest level of the cave, whereas the number of metates is very nearly the same.) This tentative conclusion suggests that we may find sites that will yield evidence for closing this gap of a thousand years or so.

Now to answer the other question. The relationship between the materials from Wet Leggett Canyon and those from the Chiricahua stage of the Cochise culture has already been shown (Martin, Rinaldo, and Antevs, 1949), but it is a gross relationship based primarily on "presence or absence" of trait-types. This statement also holds good for the relationship between stone tools of the Pine Lawn Phase and those from the Chiricahua stage of Wet Leggett and of southeastern Arizona.

The relationship between the stone tools of the Pre-Pottery Phase of the caves and from the Pine Lawn Phase, wherever found, is close, as can be shown by seriation. The transition is smooth and continuous.

Rinaldo has likewise made a comparative study of the mano, metate, scraper, and projectile point types from sites of the Southern Basin cultures—Pinto Basin, Ventana Cave, Chiricahua 3:16 (Southeastern Arizona Cochise culture)—Tularosa and Cordova caves, and has found a relationship between these stone tool types on a Pinto-Amargosa II-Chiricahua Stage time level; that is, the manos, metates, scrapers, and projectile points are similar and clearly related typologically: all have sub-rectangular one hand manos, shallow basin metates, keeled scrapers, uniface choppers, and narrow-shouldered points with concave bases. However, the proportion of chipped stone artifacts to that of ground and pecked stone is not the same in all these sites or complexes; in one, such as the Pinto, there will be more chipped than ground and pecked artifacts, and in another —the Chiricahua—the reverse may be true.

Thus, it is clear that food-gathering was an important aspect of life in the Great Basin.

And now to turn to another important aspect of the excavations in the caves; namely, what contributions have the "dry" materials made to the solution of the place of the Mogollon culture in Southwestern taxonomy?

We have postulated in all previous reports (see Bibliography) that the Mogollon was a distinct cultural entity. Our evidence for this hypothesis was based on architecture, ceramics, and tools of bone and stone.

Now, with the vast amount of perishable materials at our disposal, we feel we can strengthen our earlier postulate.

Roger Grange, Jr., has made a comprehensive study of the wooden artifacts associated with the typical Mogollon stone, bone, and pottery materials recovered from the caves. The earliest of these are older by several centuries than any other similar materials found anywhere in the Southwest. Therefore their "uniqueness" may be due to the fact that nothing of a comparable antiquity has been found in the Anasazi or Hohokam cultures. If artifacts, dating from the first centuries just before and after Christ, turn up from these last-named cultures, the picture may be altered.

On the basis of his study (Chapter VII), Grange concludes that there are some traits that distinguish the Mogollon culture from those of the Anasazi and Hohokam, especially before A.D. 700. These traits are tablitas, Juniper-berry skewers, reed stalks impaled on reed stems, sticks with knotted yucca-leaf bindings, sticks with incised patterns in the bark, twigs tied in loops, feathers bound to sticks, sticks with fiber, sinew, and hair bindings, and reed cigarettes. It will be noted that many, if not all, of these traits may be ceremonial.

Interestingly enough, ceremonial and miniature bows and arrows occur earlier in the Mogollon culture than elsewhere. Grange concludes on the basis of present evidence that this may be a Mogollon development. If the miniature bow was an invention motivated by play impulses (Kroeber, 1939, p. 46), and since it appears early in the Mogollon culture, perhaps the bow and arrow is an invention of the Mogollon Indians.

There are some wooden artifacts that are common to all Southwestern cultures, but their form or decoration differs slightly from one culture to another. These differences are significant enough so that an expert can sometimes distinguish a Mogollon from an Anasazi or Hohokam artifact. These artifacts are atlatl equipment, fire drill hearths, arrows, digging sticks, "ceremonial" reed cigarettes, and corn cobs mounted on sticks.

Grange found that there is a general similarity in utilitarian wooden specimens throughout the Southwest, both before and after A.D. 700. This is not surprising in view of the fact that all the cultures of the Southwest are linked by similar elements or characteristics through time and space—the co-tradition, in short.

The sandals, textiles, basketry, and cradles from the caves have been subjected to an intensive analysis by Miss Elaine Bluhm, whose chapter on these subjects appears herein. Her conclusions, too, may be regarded as tentative, since our earliest sandals, textiles, and basketry are as old as any other yet reported on in the Southwest. With this condition in mind, she states, subject to further data from earlier horizons of the Anasazi and Hohokam cultures, that wickerwork sandals are a southern specialty, although the Mogollon variety differs from the Hohokam. A few are reported from the Basketmaker III horizon, but this is five to seven centuries later than they occur in Tularosa Cave. Plaited sandals occur in the San Francisco Phase of the caves and may also be classed as a Mogollon development. Such sandals apparently did not appear in the Anasazi culture until Pueblo III times—several centuries later. Coiled, twined, and twilled basketry were recovered from the caves and in each instance their appearance is earlier than in Anasazi or Hohokam horizons. This seems somewhat strange because, with the exception of coiled basketry, the techniques of twining and twilling were known in very early times (before 2000 B.C.) in the Basin. One might assume that since these techniques were part of the older stratum of Basin cultures, the Anasazi (who may have been Basin-derived) would have knowledge of these arts, if they chose to adopt them. Here again, priority for some of these traits and techniques for the Mogollon culture may only be apparent and due to our ignorance of Anasazi phases or horizons, if any existed, that would date earlier than A.D. 200. More explorations and excavations may shed light on this interesting development.

I have alluded above to the general similarities and typological relationships between manos, metates, scrapers, and projectile points of the Southern Basin cultures and those from the early stages of the Mogollon culture. I have also mentioned the fact that the techniques of wickerwork, plaiting, twining, and twilling were known to some of the peoples of the Great Basin area.

This same kind of tenuous relationship exists between some wooden artifacts from early Mogollon phases and the early cultures of the Great Basin and the Pecos River area (Texas). One has the feeling that, in early times, a simple food-gathering culture existed throughout the Great Basin (including the Southwest) and Texas. Specifically, we can only point to a few resemblances or typological counterparts—manos, metates, scrapers, projectile points, some weaving techniques. On the basis of Grange's study, we might add a few wooden artifacts: atlatl equipment, digging sticks, and fire drill hearths for the Great Basin proper; and atlatl equipment, digging sticks, bark trowels, curved grooved clubs (present in Anasazi but almost lacking in Mogollon), fire drill hearths, and reed cigarettes for the Pecos River area. To be sure, these are only a few traits and prove nothing. To me, however, there appear to be hints of more and stronger relationships, as yet undiscovered. This is by no means an idea that originated with me, I hasten to state; but every now and then more evidence comes forth that props up the idea.

As I see it then, before A.D. 1 (Grange uses A.D. 700 as a watershed, but because he was working with wooden artifacts only), a relatively uniform food-gathering culture existed throughout most or much of the Basin, including Texas and northern Mexico—a mortar, mano, metate, digging stick, atlatl and dart, twined matting, fiber sandal, fur blanket, bulb-digging, nut-gathering, seed-gathering, basket-using complex, living in a common environment of sagebrush, Juniper, and arid country. The meagerness of these early Basin cultures above mere subsistence level, and the paucity of archaeological work in the Basin and good, usable reports on that area make it difficult to tie together the connections that we can sense but can not yet fully demonstrate.

After A.D. 1, pottery, agriculture, architecture and other influences from the south (Mexico) appeared and formed a regional development that resolved itself into what we now know as the Southwestern Culture or Co-Tradition, made of three or four localized subcultures—Cochise–Mogollon, Cochise–Hohokam, Mogollon–Anasazi, and Hohokam–Mogollon–Patayan. The Southwest cultures drew together, as it were, diverged, developed, and became more complex than the Basin and the Pecos areas.

The Basin and the Pecos areas, however, stood still. They did not develop as did the Southwestern culture. The cultures of the Basin and the Pecos areas may represent a survival of a relatively uniform culture pattern that existed from Oregon to Mexico prior to A.D. 1, and may represent the type of culture pattern that was once common to this whole area.

Why did the Southwestern cultures crystallize, leaving behind in solution their cultural brothers? Kroeber (1939, p. 46) suggests two factors: cultural and natural. Kroeber is here speaking of the Pueblo culture, but he may be implying the Southwestern cultures as a whole; or, if he does not mean that, I would add that interpretation—i.e., the Southwestern Co-Tradition—to what he wrote. One should remember that this monograph was completed in 1931, and published eight years later. At that time, we knew nothing of the Mogollon or Hohokam cultures.

I do not know enough nor are there enough data extant to conjecture further on the Southwest-Texas-Great Basin affinities; but I have touched on them as being part of a larger problem to which our cave data contribute.

Did our cave excavations shed any light on the reasons for the exodus of the Mogollon people and on their fate? No.

Did we discover any more data pertaining to the social organization of the Mogollon Indians? Yes. We found a confirmation of the trends in tool types and the development of agriculture and pottery that were roughly outlined in our report on sites of the Reserve Phase (Martin and Rinaldo, 1950b, pp. 556-569).

We discovered that the Mogollon people possessed ceremonial equipment (previously assumed but not known); that they wore aprons and sandals, and used fur robes; that they treated their dead with tenderness and possible affection; that they may have believed in life after death because they buried the dead with clothing; that they were not neat or tidy, but tended to live in what we would call an unsanitary manner (oral characteristics?); that psychosomatic medical practices may have been in vogue; that they may have played games; that they solved their daily problems in an efficient, mature way, given their limited resources.

Certainly, certain culture processes seem to have been operating. Stable periods were noted, during which time the various parts of the culture were preserved; and three major shifts were reflected in our data—shifts that produced instability, with resultant growth and change. The best example of this culture process, as illustrated by our cave dig, comes from the Georgetown and San Francisco levels. Each author, working independently, found that the materials from these time horizons reflected instability, change, additions, subtractions and re-formation and new crystallization.

Cutler observed that the Georgetown levels of Tularosa Cave yielded a larger proportion of gathered *wild* plants than *cultivated* plants (corn, squash, beans). This seems to indicate significant modification of the subsistence patterns of the Mogollon people. For several centuries, corn, beans, and squash had supplied the major food needs and the ancient practice of gathering and eating wild plants had dwindled. But here—during the Georgetown Phase (A.D. 500-700)—we find this trend reversed. This unexpected veering in the drift of stable culture patterns is rather startling—

as extraordinary as if we were to shift to a diet of grilled worms garnished with grass seeds, fried grubs, and parched grasshoppers.

We do not know what induced this deviation in food patterns. Perhaps the determinant was a natural cataclysm of sorts. But we do know that it must have wrought havoc with the entire culture pattern, for we find shifts, substitutions, and borrowing starting during this epoch. In the past, we have been able to list changes from one period to another and have made guesses as to why they came about, but here we seem to have a motivation for changes that are clearly observable during and after the Georgetown Phase. We have here evidence better than is given to most archaeologists and almost as good as that which an ethnologist might obtain.

What are some of the major modifications that are associated with and subsequent to this change in food habits. I shall list some of them, but not in detail, because minutiae may be gleaned from the preceding chapters, and the time I am writing of covers the Georgetown and San Francisco phases (roughly A.D. 500–900). They are: (1) introduction of painting and texturing on some pottery; (2) commencement of trade with the Anasazi, as shown by the presence of Anasazi Black-on-White pottery; (3) a decrease in the number of digging sticks and a corresponding increase in stone hoes; (4) the appearance of saws (stone) and animal effigies; (5) a shift in the technique of spinning bast-fiber from a Z-twist to an S-twist; (6) an increased usage of cotton; (7) introduction of woven cloth; (8) the start of a shift from wickerwork to plaited sandals; (9) the presence of Anasazi-like sandals; (10) the gradual replacement of the atlatl by the bow and arrow; (11) introduction of the miniature bow and arrow and changes in ceremonial equipment; (12) a corn with low row numbers; (13) less emphasis on hunting; and (14) a shift in certain types of pit-houses from round, shallow ones to deep, rectangular ones.

Lest one receive the impression that all was changed, it might be well to point out that before, during, and after these shifts, there were certain continua. The continua were: (1) plain brown and red pottery wares; (2) round, shallow pit-houses; (3) some metate and projectile point types; (4) coiled basketry; (5) fur-and-feather-cord robes; (6) method of spinning hard-fiber cordage; (7) emphasis on agriculture, some food-gathering, and decrease in emphasis on hunting. Some traits—for example, wickerwork sandals and atlatl equipment—also represent continuity by persisting for a limited period of time along with newly acquired traits, such as plaited sandals and the bow and arrow; and likewise represent change by slowly declining in popularity until they disappeared.

Thus, while there is change there is continuity; and while there is continuity, there is change. We do not envisage very abrupt shifts or substitutions such as the atlatl yesterday and the bow and arrow today. We feel, rather, that all changes were slow, perhaps sometimes opposed, but that once they had been initiated, they proceeded inexorably.

Most of the culture change that has been suggested here may have been due to factors external to the Mogollon culture. Certainly diffusion was responsible for agriculture, ceramics, and architecture. These in turn, having been socially accepted and probably reworked to fit the culture pattern of the Mogollon people, induced internal and important culture changes: a steadier and more ample food supply that would probably cause some increase in population; an intensification in the patterns of social organization in accordance with the "drift" already established (Martin and Rinaldo, 1950b, p. 565); and some changes in fashion trends (sandal types, pottery decoration, tool types, and the like).

But in spite of near "revolutions" and diffusions, the *traditions* of the Mogollon culture persisted with considerable vigor. At or near the end of the life of the Mogollon culture as we now know it, we find that some Cochise-like stone tools were still in use, depressed house floors were in vogue, and incised, punched, scored and brown, red, and smudged types of pottery still prevailed, notwithstanding replacements, losses, inventions, and increments. The Mogollon culture retained its special flavor and its essential characteristics.

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